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Exploration and Geological Services Division, Yukon Region

BULLETIN 13

Placer gold deposits of the Mayo area, central Yukon

W.P. LeBarge, J.D. Bond and F.J. Hein

with contributions from
L. Weston, T. Allen, L. Walton

Yukon Energy, Mines & Resources
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Cover photo: Placer gold in the Mayo area occurs in several settings including alluvial fan-deltas, such as in this photo of Anderson Creek on Mayo Lake. Most placer mining has been concentrated at the apex of the fans, however recent exploration has found placer gold deposits in distal parts of the fan.

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Placer gold deposits of the Mayo area, central Yukon

by
W.P. LeBarge[1], J.D. Bond[1] and F.J. Hein[2]

with contributions from
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2002

Preface

A study of the geological setting of placer deposits in the Mayo area was initiated in 1995 by William LeBarge, DIAND Placer Geologist. In 1996 and 1997, Bill was joined by a multidisciplinary team of researchers including surficial geologist Jeff Bond (Yukon Geology Program), and sedimentologists Frances Hein (University of Calgary), Leyla Weston (University of Calgary/Yukon Geology Program) and Tammy Allen (Yukon Geology Program). In 1998, Bill continued to gather stratigraphic and sedimentologic data from drainages in the Mayo area. This bulletin is a compilation of the work conducted during those several seasons of fieldwork in the Mayo area.

The aim of this study was to characterize placer deposits in a glaciated setting, particularly in this area at the margins of two glaciations, where the potential for placer gold deposits is highest. This study was successful in combining surficial geological mapping, geomorphology and detailed sedimentology, and lead to four placer deposit models being proposed in this glaciated setting. These new placer deposit models for glaciated areas represent an important step forward in the study of placer gold settings.

These studies could not have been completed without the cooperation and support of local placer miners, prospectors and mining companies and their assistance was greatly appreciated. We hope the publication will assist in the discovery and development of new placer resources, and that it will serve as a valuable information source for other scientists and the interested public.

Préface

Une étude du cadre géologique des placers dans la région de Mayo a été entreprise en 1995 par William LeBarge, géologue spécialiste des placers au MAINC. En 1996 et en1997, une équipe multidisciplinaire de chercheurs s'est jointe à Bill, incluant le géologue spécialiste des dépôts meubles Jeff Bond (service de géologie du Yukon) et les sédimentologues Frances Hein (Université de Calgary), Leyla Weston (Université de Calgary/service de géologie du Yukon) et Tammy Allen (service de géologie du Yukon). En 1998, Bill a poursuivi la cueillette de données stratigraphiques et sédimentologiques sur les bassins versants dans la région de Mayo. Ce bulletin présente une compilation des travaux menés au cours de plusieurs saisons sur le terrain, dans la région de Mayo. Cette étude avait pour but de caractériser les placers dans un cadre géologique glaciaire, particulièrement dans cette région aux limites de deux glaciations où le potentiel pour les placers aurifères est optimal. L'étude a permis de combiner la cartographie géologique des dépôts meubles, la géomorphologie et la sédimentologie détaillée, et a mené à la proposition de quatre modèles de placers dans un cadre géologique glaciaire. Ces nouveaux modèles de placers pour des régions glaciaires constituent une étape importante dans l'étude des cadres géologiques pour des placers aurifères.

Ces études n'auraient pas pu être menées à terme sans la collaboration et l'appui des exploitants locaux de placers, des prospecteurs et des sociétés d'exploitation minière, dont l'aide a été grandement appréciée. Nous espérons que cette publication contribuera à la découverte et à la mise en valeur de nouvelles ressources placériennes, et qu'elle constituera une source d'information précieuse pour d'autres scientifiques et pour les personnes intéressées.

Grant Abbott

Chief Geologist	Géologue en chef
Exploration and Geological Services Division	Division des services d'exploration et de géologie
Yukon Region, Indian and Northern Affairs Canada	Affaires indiennes et du Nord Canada, région du Yukon

Acknowledgements

Studies of this type do not get off the ground without considerable cooperation and assistance from several individuals and organizations. Thanks of course are due to the other contributing researchers for their excellent work: Jeff Bond, Fran Hein, Leyla Weston, Tammy Allen and Lori Walton. Excellent field assistance and interesting geological discussions were provided by Claire Wilson, Lisa MacKinnon, Dylan MacGregor and Mark Skidmore. Much appreciation goes to the many placer miners and families that gave assistance and cooperation to the project team, often well beyond what we could have imagined. In conducting this study we unexpectedly gained a new circle of friends – including the Taylor family (Frank, Bonnie, Troy, Todd, Tami), the Klippert family (Dan and Dee, Kim and Cheryl) and the Holway family (Ron, Fred and Caroline).

Others that contributed in the field and office include Paulina Mindermann, Erika Kotler, Jason Adams, Mark Nowosad, Melanie Reinecke, Panya Lipovsky, Alison Hartley, Cheryl Peters, and Julianne Madsen. Kennecott Canada kindly provided some of the digital topography of Highet Creek. Aerial support was skillfully provided by Harmen Keyser, Pat Dayman and Will Thomson of Trans North Helicopters.

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Abstract

Placer deposits in the Mayo area occur in a wide variety of geomorphic settings, including alluvial fans, gulch gravel, valley-bottoms (alluvial plains), and bedrock terraces (bench gravel), which have been variably buried and reworked by glaciofluvial processes. Placer gold also occurs in glacial till and glaciofluvial gravel, especially where these sediment types have intersected pre-existing placer deposits, resulting in the reconcentration of gold in a zone close to bedrock.

The Yukon has been subjected to several major episodes of glaciation, which are generally referred to as the pre-Reid (oldest), the Reid (intermediate), and the McConnell (youngest) glaciations. The pre-Reid glaciation consisted of multiple episodes, the earliest being at least 2.58 Ma. Although the Mayo area was heavily glaciated during the pre-Reid episodes, limited surficial deposits remain, and evidence mainly consists of erosional features and erratics at higher elevations. The subsequent Reid (approximately 300 000 years ago) and the McConnell (approximately 20 000 years ago) glaciations reworked and buried pre-existing glacial drift and alluvium, and left extensive surficial deposits.

While the timing of the interglacial prior to the Reid is uncertain, the Koy-Yukon interglacial prior to the McConnell glaciation lasted approximately 170 000 years. The modern (Holocene) interglacial began approximately 11 000 years ago. These three interglacials have been the main placer-forming periods in the Mayo area.

The complex stratigraphy of placer deposits in the Mayo area reflects its glacial and periglacial history. Within the glacial limit, placer deposits are best preserved near the maximum limit or terminus, where the scouring of pre-existing sediment was minimal and depositional processes were dominant. Beyond the glacial limit, periglacial climatic conditions resulted in increased slope and alluvial sedimentation that buried and reworked paleoplacers.

Based on surficial mapping, stratigraphic relationships and sedimentology, several placer deposit models may be described within the Mayo area. These can be grouped into modern, interglacial, glacial or periglacial placer settings.

Modern placers include alluvial fans, fan-deltas, alluvial plains and gulch deposits. Interglacial placer settings in the Mayo District include alluvial plains, alluvial fans and low terraces along second and third order streams and rivers, and gulches in first order tributary valleys. These are commonly buried and reworked by glacial drift and periglacial fan sediments. Glacial placer settings in the Mayo area include glacial till and glaciofluvial gravel in major valleys, the most significant of which are Reid age or older. Periglacial placers include alluvial fans in tributary valleys and fan-deltas along major water bodies including Mayo Lake.

Placer exploration targets occur in all of the above settings, however the most significant are those that remain buried in trunk valleys, which were not post-glacially re-excavated due to base-level changes. Substantial placer gold reserves may exist in these valleys but their potential remains to be evaluated. Suggested methods include a combination of seismic surveys, overburden drilling and bulk sampling.

Résumé

Les placers de la région de Mayo se présentent dans une grande variété de cadres géomorphologiques, incluant les cônes alluviaux, le gravier des ravins, les fonds de vallées (plaines alluviales) et les terrasses du substratum rocheux (gravier de terrasse), qui ont été enfouis de diverses façons et remaniés par les processus fluvio-glaciaires. On trouve aussi de l'or placérien dans du till glaciaire et du gravier fluvio-glaciaire, notamment aux endroits où ces types de sédiments recoupent des placers préexistants, donnant lieu à la reconcentration de l'or dans une zone proche du substratum rocheux.

Le Yukon a subi plusieurs épisodes importants de glaciation, que l'on désigne comme les glaciations de pré-Reid (la plus ancienne), de Reid (intermédiaire) et de McConnell (la plus récente). La glaciation de pré-Reid comprend de multiples épisodes dont le plus ancien remonte à 2,58 M.A. Bien que la région de Mayo ait été considérablement érodée par les glaciers au cours des épisodes pré-Reid, il reste peu de dépôts de surface et les seuls vestiges consistent en des formes érodées et des erratiques à des altitudes plus élevées. Les glaciations subséquentes de Reid (il y a environ 300 000 ans) et de McConnell (il y a environ 20 000 ans) ont remanié et enfoui les dépôts glaciaires et alluvionnaires préexistants et ont laissé de nombreux dépôts de surface.

Alors que la durée de l'interglaciaire antérieur à la glaciation de Reid est incertaine, l'interglaciaire de Koy-Yukon antérieur à la glaciation de McConnell a duré approximativement 170 000 ans. L'interglaciaire contemporain (Holocène) a commencé il y a approximativement 11 000 ans. Ces trois périodes interglaciaires ont été les principaux événements favorables à la formation des placers dans la région de Mayo.

La stratigraphie complexe des placers dans la région de Mayo est le reflet de son histoire glaciaire et périglaciaire. À l'intérieur des limites glaciaires, les placers sont les mieux conservés près de la limite de l'extension maximale ou front glaciaire, où le décapage de sédiments préexistants était minimal, tandis que les processus de sédimentation prédominaient. Au-delà des limites glaciaires, les conditions climatiques périglaciaires ont entraîné une sédimentation accrue sur les pentes et sous forme d'alluvions, contribuant à l'enfouissement et au remaniement des paléoplacers.

S'appuyant sur la cartographie des matériaux de surface, les liens stratigraphiques et la sédimentologie, on peut décrire plusieurs modèles de placers dans la région Mayo. On peut grouper les placers selon le contexte : contemporain, interglaciaire, glaciaire et périglaciaire.

Les placers contemporains comprennent les cônes alluviaux, les deltas alluviaux, les plaines alluviales et les dépôts dans les ravins. Les placers de milieu interglaciaire dans le district de Mayo incluent les plaines alluviales, les cônes alluviaux et les terrasses peu élevées le long de ruisseaux et de cours d'eau de deuxième et de troisième ordre, et les ravins de vallées tributaires de premier ordre. Ceux-ci sont souvent enfouis et remaniés par les dépôts glaciaires et les sédiments alluviaux périglaciaires. Les placers de milieu glaciaire dans la région de Mayo comprennent du till glaciaire et du gravier fluvio-glaciaire dans les vallées principales, dont les plus importants sont de la période Reid ou d'une période antérieure. Les placers périglaciaires comprennent des cônes alluviaux dans des vallées tributaires et des deltas alluviaux en bordure de plans d'eau importants, y compris le lac Mayo.

On a des objectifs d'exploration des placers dans tous les contextes mentionnés ci-dessus, cependant les plus importants demeurent enfouis dans les vallées principales, qui n'ont pas été recreusées après les glaciations en raison de changements du niveau de base. Des réserves importantes en or placérien pourraient se trouver dans ces vallées mais leur potentiel reste à évaluer. Les méthodes d'évaluation proposées comprennent une combinaison de levés sismiques, de forages des morts-terrains et d'échantillonnage global.

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Bond, J.D., 1998f. Surficial geology of Dublin Gulch map area, central Yukon (106D/4). Geoscience Map 1998-6, 1:50 000 scale.

Bond, J.D., 1999. Glacial limits and ice flow patterns, Mayo area, central Yukon. Geoscience Map 1999-13, 1:250 000 scale.

Lipovsky, P., Bond, J. and LeBarge, W., 2001. Mayo area placer activity map, portions of NTS sheets 105M, 106D, 115P and 116A, Yukon (1:250 000 scale). Open File 2001-35.

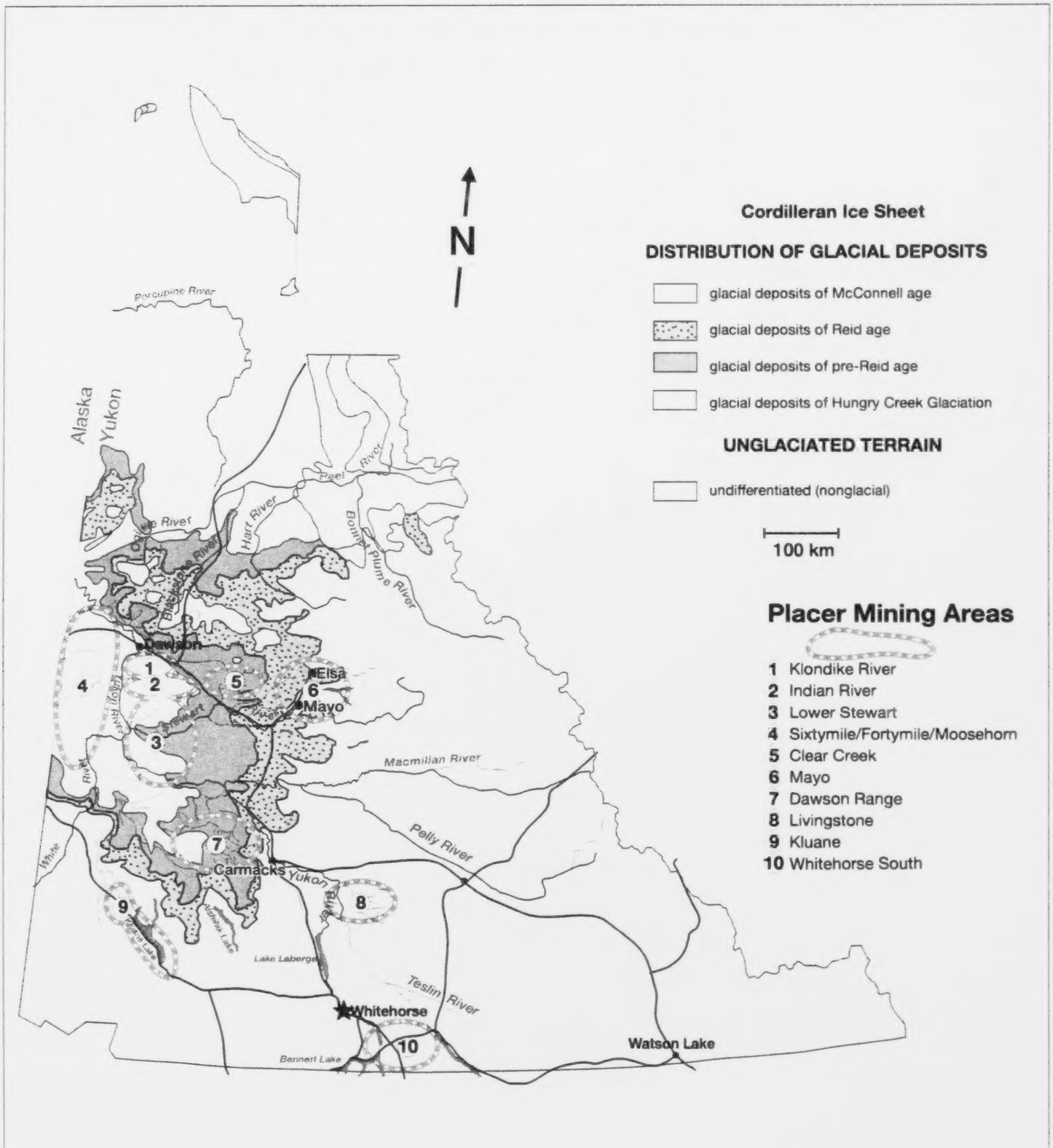


Figure 1. Extent of Pleistocene glaciations and placer gold mining areas in Yukon (modified after Duk-Rodkin, 1998).

INTRODUCTION

The Yukon Geology Program initiated a study of the geological setting of placer deposits in the Mayo area in 1995. In May, 1996, this work continued in the form of a two-year research project designed to identify new placer potential in the Mayo Mining District. This program was largely completed as a research contribution agreement between the University of Calgary (Department of Geology and Geophysics), the Yukon Geology Program (Economic Development Branch, Yukon Government) and Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada, which funded logistical and staff support. Emphasis of this study focused on the sedimentology and stratigraphic setting of the western part of the Mayo Mining District, and included detailed stratigraphic and sedimentological work in the Duncan Creek, Mayo Lake, Haggart Creek and Highet Creek areas (Fig. 2). In conjunction with the sedimentology and stratigraphy studies, surficial mapping and geochemical studies were completed along the northern extent of the Mayo Mining District.

The Mayo area is a unique district in which to examine the sedimentology of placer deposits due to the combination of well-known lode sources with a mineral zoning pattern (Franzen, 1986; Lynch, 1986, 1989; Watson, 1986), and documented placers with interesting suites of associated heavy minerals. Furthermore, the area is at the limit of several glacial ice advances, therefore allowing the opportunity to examine the distribution of gold placers within glacial sediments and glacially influenced landforms.

This bulletin complements another study of glacial placers, the Mount Nansen area of central Yukon, in which significant amounts of placer gold are associated with a glacial diamicton at the diamicton/bedrock contact (LeBarge, 1995).

LOCATION OF STUDY AREA

The study area is located within the Mayo Mining District, central Yukon, approximately 400 km by road north of Whitehorse (Figs. 1, 2). The area is part of the Stewart Plateau, northeast of the Tintina Trench, and is proximal to the southern foothills of the Ogilvie Mountains. Most of the study area lies north of the village of Mayo and can be accessed by road, with the exception of Empire Creek, which lies south of Mayo and is accessible only by winter road or helicopter. Sedimentological studies were conducted on the major drainages within these areas, including: Haggart Creek and its tributaries, Duncan Creek and its tributaries, Mayo Lake, Seattle Creek and Highet Creek. This encompasses NTS map areas 116A/1, 106D/4, 115P/15, 115P/16, 105M/13 and 105M/14.

PREVIOUS WORK

Enclosed with this bulletin are eight previously released and updated maps, including six 1:50 000 surficial geology maps (Bond, 1998a; Bond, 1998b; Bond, 1998c; Bond, 1998d; Bond, 1998e; Bond, 1998f); and two 1:250 000 scale maps, one showing glacial limits and flow patterns (Bond, 1999), and the other showing placer mining activity in the Mayo area (Lipovsky et al., 2001).

A review of previous work on placers and surficial deposits of the Mayo Mining District is presented in LeBarge (1996a, 1996b), with some highlights summarized here. Surficial geology and/or placer-related studies in central Yukon include Bostock's (1948, 1966, 1969) compilations of glacial limits; Hughes' detailed mapping of the McConnell glacial limits (Hughes, 1982, 1987; Hughes et al., 1969, 1972); Duk Rodkin's (1999) compilation of glacial limits; Quaternary geology studies by Giles (1993) of sections near the Mayo town site and Mayo Indian Village; Pleistocene mammal studies of Dublin Gulch and the Mayo placer mining areas by R. Harrington (pers. comm.); soil surveys and revegetation studies of selected mining areas near Mayo (Mougeot, 1993; Wilson et al., 1996) and permafrost studies in the Mayo and Duncan Creek areas (Burn, 1990, 1994; Burn and Friele, 1989). Mougeot and others have produced a series of geological processes and terrain hazard inventory maps for Mayo and the surrounding area (Yukon GEOPROCESS File, 2002; Mougeot and Walton, 1996a, 1996b, 1996c; Doherty et al., 1994). Earlier geochemical work on gold by Boyle and others focused on the Keno Hill area (Kindle, 1955; Boyle and Gleeson, 1972; Boyle, 1979). Bedrock gold-silver occurrences were compiled for the Yukon by Morin (1989), with a more detailed compilation of placer gold/silver occurrences in the Mayo area by Kreft (1993) and Carlyle (1995a, 1995b). This work has been incorporated into the Placer MINFILE by Hein et al. (1996). Regional geochemical stream sediment and water geochemical data for the Mayo map area (105 M) were

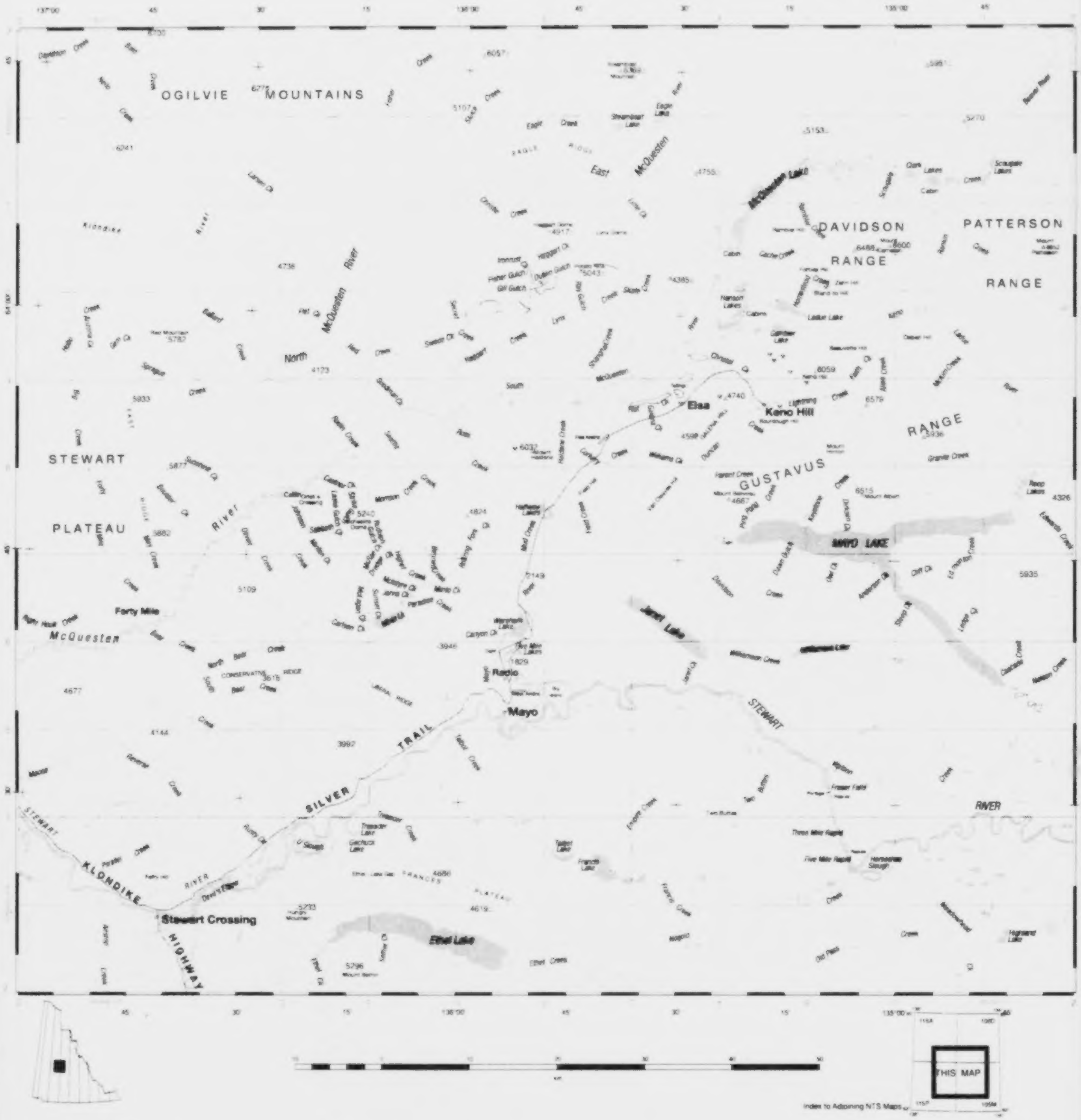


Figure 2. *Mayo placer area, central Yukon.*

collected and collated by the Geological Survey of Canada (Friske and Hornbrook, 1989). Regional overviews of placer geology in the Yukon are given by Morison (1989) and McLeod and Morison (1996), with summaries of central Yukon by LeBarge (1996a). Bedrock mapping in the Mayo area includes Poole (1965), Green (1971, 1972), Hunt et al. (1996), Murphy and Roots (1996), Roots (1991, 1997), and Roots and Murphy (1992a, 1992b). Lynch (1986, 1989) studied mineral zoning within bedrock in the Keno Hill area. An investigation into reprocessing of tailings at Elsa was completed by Hawthorne (1996).

Other studies of interest include the origin and permafrost characteristics of the "muck" in the Klondike region (Fraser, 1995; Fraser and Burn, 1997; Kotler, 1998); Harris' (1994) chronostratigraphic studies of glaciations and permafrost in the Cordillera; mapping of glacial limits and surficial deposits in the Dawson area and Mackenzie Mountains (Duk-Rodkin, 1996; Duk-Rodkin and Hughes, 1991; Duk-Rodkin et al., 1996); paleosol development in central Yukon (Rutter et al., 1978; Smith et al., 1986; Tarnocai et al., 1985; Tarnocai and Schweger, 1991); sedimentological studies on the Klondike Terrace placer gravels near Dawson (Froese, 1997; Froese and Hein, 1996); sedimentology and stratigraphy of placer deposits within the Haggart Creek drainage near Mayo (Weston, 1999); Quaternary and surficial geology of the McQuesten map area (Bond, 1996, 1997a, 1997b); and plant and insect fossil studies from the Mayo Indian Village section (Matthews et al., 1990).

FIELD AND LABORATORY METHODOLOGY

Surficial geological mapping, and detailed stratigraphic section descriptions of mine-cut, road, or stream-cut sections, are the main field data included in this study. In 1995, reconnaissance studies centred on the Duncan Creek and Mayo Lake areas, with some preliminary work in the Gill Gulch, Highet, Haggart, Goodman and Seattle Creek drainages. During the 1996 and 1997 field seasons, Reid and McConnell limits were mapped mainly in the eastern and central parts of the study area, and this work was published as six surficial maps and a glacial limits map (Bond, 1998a-f; Bond, 1999, in pocket, Fig. 3). Within the study area, 165 sites were visited for sedimentological and stratigraphic description, of which 138 were of sufficient exposure for detailed stratigraphic analysis (Appendices 1 and 4). Sites in areas of active placer mining were revisited during the field season to document sequential changes in sediment types and facies. These mining operations gave excellent exposure of vertical and lateral facies trends, and allowed the opportunity to ascertain the stratigraphic relationships between different units. Additional natural exposures and gravel pits along stream and road courses were measured for stratigraphic and sedimentological control. Sections were described with emphasis on physical sedimentary features, including: grain size, bed thickness, gravel fabric, primary sedimentary structures, and lithology and rounding of clasts. Other descriptive criteria included: cryogenic features such as ice-wedge casts, ice-loading contacts, and disruption of primary features; colluviation and down-slope wasting; and pedogenesis. Samples were collected for grain-size, heavy mineral, geochemical, radiocarbon, palynological and mineralogical analyses.

Approximately 180 bulk gravel samples were collected between 1995 and 1998. Sampled areas were scraped using a shovel to remove any surface debris and to avoid contamination. The shovel was cleaned and then used to obtain approximately 2-5 kg of bulk gravel sample. Selected samples were panned on site to document any presence of gold, while most samples were collected for grain size and heavy mineral analysis. Grain size samples were dried, split to 1.5 kg samples and sieved through #4, #10, #18, #35, #60, #120 and #230 Tyler mesh screens (Folk, 1974).

Heavy minerals from 146 samples were initially processed by recombining the #18 to #120 mesh fractions and hand panning down to a small concentrate. After heavy liquid separation, the minerals were examined with a binocular microscope and selected grains were sent for microprobe analysis. Appendix 2 details results of this study.

A total of 40 organic samples were collected for ^{14}C dating. Wood was sampled wherever possible to avoid any root contamination, which commonly occurs when bulk-sampling organic-rich soil samples.

Thirteen samples were obtained for palynological studies. Sample sites were chosen based on sediment colour, size and texture. Typical high pollen sediment is dark, fudge-brown colour and has a fine-grained texture (silt-sized particles). Samples were obtained by first digging into the section approximately 10 cm to avoid sampling any contaminated material. Approximately 500 g of sample was collected using a small, clean trowel.

In conjunction with the surficial mapping, 121 stream sediment samples were collected for geochemical

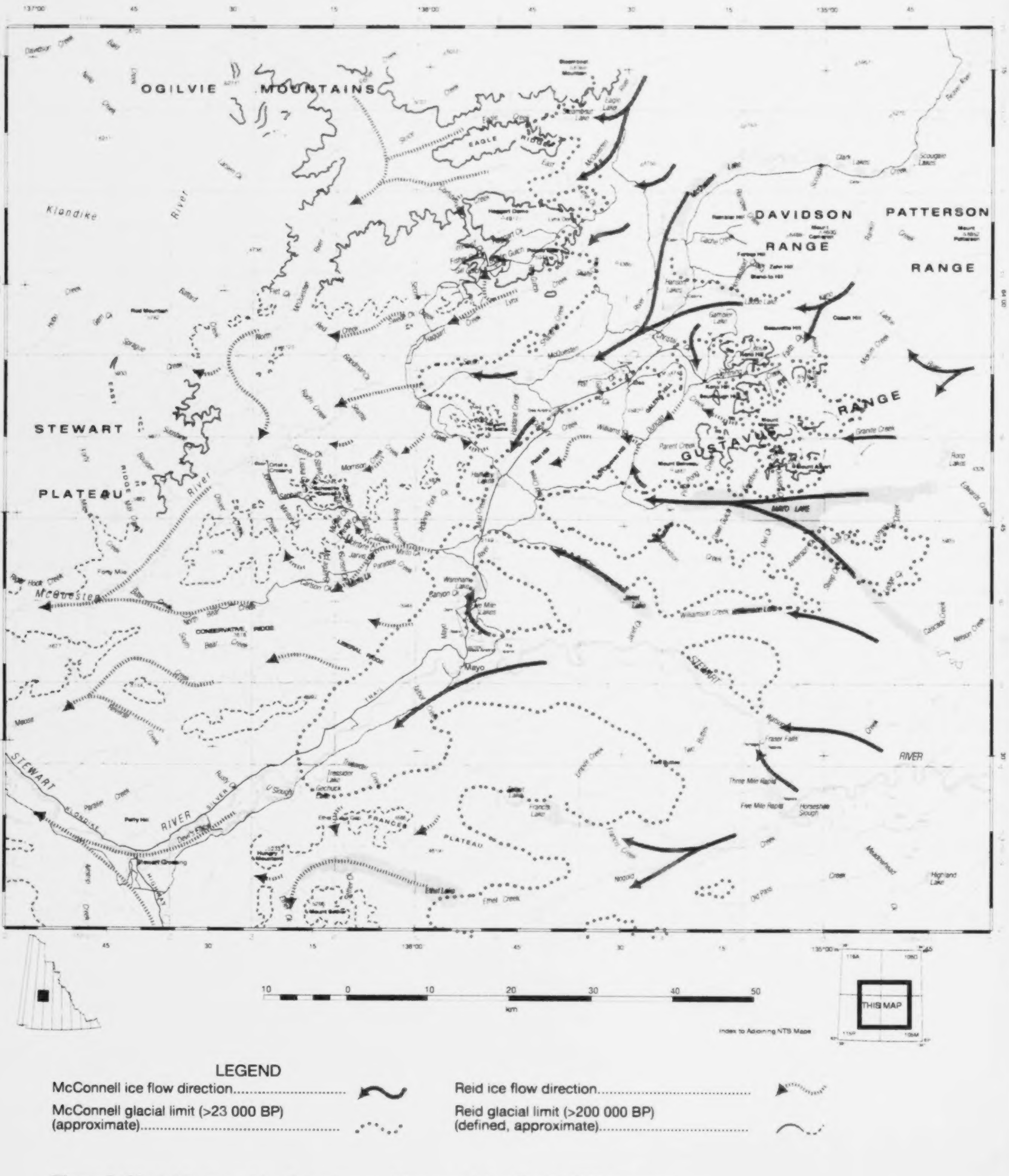


Figure 3. Glacial limits and ice flow patterns, Mayo area (after Bond, 1999. in pocket).

analyses. Sample collection targeted fine-grained sediment trapped either in moss mats or in overbank deposits. The sample material was sieved on site through a 1-mm screen. Samples were air dried at Chemex Labs and then further sieved to extract the minus #80 mesh component of the sample. The samples were analysed for 32 elements by a nitric-aqua-regia leach – ICP/AES (inductively-coupled plasma/atomic emission spectroscopy). Gold analysis was completed using fire assay. The detection limits for gold and the 32 elements are outlined in Appendix 3. The gold values (ppb) are also presented on the surficial geology maps.

MINING HISTORY

Lode mining

Lode gold was discovered in Dublin Gulch in 1907 (Mayo Historical Society, 1990). The first recorded discovery of silver-lead was the Silver King vein on Galena Hill, found in 1903; high grading took place from 1913 to 1915. In 1919, rich silver-lead ore (No. 9 vein) was discovered on Keno Hill. This operation sparked a staking rush and prospectors staked much of the ground on Keno Hill and Galena Hill. Since that time, the Mayo area has seen a large number of silver-lead mines, the most important one being United Keno Hill Mines Ltd., which consolidated most of the properties in 1945.

The Keno Hill camp was once Canada's second largest producer of silver. Table 1 summarizes the production history of lode mining in the Keno Hill area. Almost 50% of the total has come from the Elsa, Keno (No. 9), Lucky Queen, Silver King, Sadie-Ladue and Husky Mines. Over 1.8 million kg of cadmium and nearly 100 000 g of gold have also been recovered.

Placer mining

The discovery of placer gold in the Mayo district began on the Stewart River in 1883. A party of prospectors worked from the mouth of the Stewart River to the McQuesten River and mined US$10 per day on river bars (Mayo Historical Society, 1990). During the winter of 1894-1895, several bars on the Stewart River were found that produced 50 cents to the pan. By the summer of 1895, approximately 75 men had stampeded into the area to mine the bars. Ogilvie estimated that between 1885 and 1886 US$300 000 was taken from the bars, with occasionally up to $100 per day (Mayo Historical Society, 1990). This equates to 14,500 fine ounces (451 000 g) in two years from rocker-box technology, or $3.8 million at US$265 per ounce today. The Stewart River thus became the grubstake river for many prospectors in the central Yukon, and provided a means to fund exploration in tributaries further east (Mayo Historical Society, 1990).

In 1892, Ray Stewart discovered gold on the McQuesten River, and in 1895 placer gold was noted on Haggart Creek. Discovery claims were recorded on Johnson and Haggart Creeks in 1898. At this time a Swedish trio named Gustavson had located themselves at the canyon on Duncan Creek, approximately 15 km upstream from its confluence with the Mayo River. For about two years the Gustavsons mined the canyon deposit, undisturbed, and had avoided recording their claim for fear of initiating another stampede. In 1901, to the Swedes misfortune, four young Dawson stampeders discovered their camp and the Gustavson trio lost their discovery and some of the best paying ground in the Mayo district. The Swedes left the country with gold valued at US$30 000 (Mayo Historical Society, 1990). The stampede to Duncan Creek began not long after and soon the entire length of

Table 1. History of lode mining production, Keno Hill area

Years	Company	Tonnes milled	Silver (kg)	Lead (kg)	Zinc (kg)
1921-1941	Treadwell	588 503.4	1 533 087. 3	44 008 249.0	
1953-1956	Galkeno	102 408.8	117 818. 6	5 396 968.6	2 816 255
1953-1954	Bellekeno	10 499.9	27 961. 5	1 573 419.5	166 552
1941-1982	others	841.9	8 314. 1	480 322.0	6 322
1946-1988	United Keno	4 170 169.0	5 081 832.0	222 163 088.0	150 209 254
1921-1988	**Total**	**4 872 423.0**	**6 769 013. 5**	**273 622 047.0**	**153 198 383**

the creek was staked. Exploration in surrounding regions began shortly thereafter, and discoveries were posted on creeks flowing into Mayo Lake and in the Minto Creek region in 1903. This included the rediscovery of Highet Creek and its bench deposit. Warren Hiatt had reportedly discovered gold on Highet Creek prior to 1903 while working in Johnson Creek, but had written it off as having water problems (Mayo Historical Society, 1990). During the overflow from Duncan Creek, re-examination revealed that Highet Creek contained a significant quantity of gold. Rudolph Rosmusen and partners acquired an area of the bench opposite Rudolph Gulch and found the richest bench ground on the creek, yielding upwards of US$140 000 or 6773 fine ounces (210 664 g) of gold at US$20.67 per ounce. The amounts on these claims alone surpassed the total gold taken out of Duncan Creek in its first 14 years. In 1920 the Highet Creek Dredging Co. attempted to dredge Highet Creek, however, this lasted only a year and a half due to the inability of the dredge to handle large boulders.

Intermittent activity continued until an upsurge of mining occurred following the dramatic rise in the price of gold in the late 1970's and early 80's. Modern methods of mining, utilizing large bulldozers and excavators have become prevalent, especially in areas that were once considered to be too deeply buried by barren glacial overburden. Although most modern mining is still concentrated on the creeks, which were initially mined at the turn of the century, some new ground has been explored and mined on a few non-traditional creeks. Today, successful placer mining of the widespread glaciated terrain has required exploring deeper channels, bench settings, or isolated pockets adjacent to the traditional sites. Placer gold mining continues to be a major contributor to the economy of the Mayo area. Although records prior to 1978 are sparse and incomplete, recorded placer gold production from available sources at Mineral Resources, Indian and Northern Affairs Canada, is given in Table 2. Historic and current placer mining activity in the Mayo area are shown on a 1:250 000-scale compilation map along with glacial limits and flow patterns (Lipovsky et al, 2001, in pocket).

Table 2. *Placer gold production, Mayo District*

Stream or river	Tributary to	Gold production 1874-2000 (crude ounces)	(grams)
Anderson	Mayo Lake	434	13 499
Bear	McQuesten	1331	41 399
Carlson	Minto	105	3 266
Davidson	Mayo River	1596	49 641
Dawn	Mayo Lake	15	466
Dirksen	Mayo Lake	31	964
Dublin Gulch	Haggart	27,177	845 300
Duncan	Mayo River	33,277	1 035 031
Empire	Francis Creek	997	31 010
Gem	Sprague	428	13 312
Haggart	S. McQuesten	50,574	1 573 028
Highet	Minto	46,743	1 453 871
Hope Gulch	Lightning	8	249
Johnson	McQuesten	12,935	402 324
Ledge	Mayo Lake	6137	190 882
Lightning	Duncan	4667	145 160
McQuesten	Stewart	27	840
Minto	Mayo River	1508	46 904
Morrison	Seattle	16	498
Russell	Macmillan	287	8 927
Seattle	McQuesten	208	6 470
Steep	Mayo Lake	219	6 811
Stewart	Yukon	6735	209 482
Swede	Haggart	3830	119 126
Thunder	Lightning	4434	137 913
Vancouver	McQuesten	928	28 864
Various Mayo creeks		1565	48 677
Total		**206,212**	**6 413 915**

GENERAL SETTING

BEDROCK GEOLOGY

A generalized bedrock geology map is given in Figure 4. Bedrock in the Mayo area includes Upper Proterozoic - Lower Cambrian Hyland Group metasandstone, conglomerate, siltstone, shale and phyllite; Ordovician Road River Group siltstone and chert; Devonian Earn Group coarse chert-pebble conglomerate, sandstone, siltstone, with minor dark grey to black limestone and chert, and Mississippian Keno Hill Quartzite (Murphy and Héon, 1994; Roots, 1997). The Hyland Group is divided into two formations, the Yusezyu and the Narchilla. The older Yusezyu formation comprises predominantly phyllite, metasiltstone, medium- to coarse-grained metasandstone, metaconglomerate, and sandy marble, whereas the Narchilla Formation includes quartzofeldspathic sandstone, maroon and green argillite, and grey weathered marble (Green, 1971; Murphy and Héon, 1994).

These metasedimentary rocks occur in broad, open folds and widely spaced thrust faults offset by narrow, northwesterly trending faults. In the central and northern part of the study area, Mississippian Keno Hill Quartzite is locally intensely fractured, folded and foliated with prominent quartz-veining, and intruded by local diabase and metadiorite dykes and sills. The Robert Service Thrust Fault, which traverses the area from Mt. Haldane to Tiny Island Lake, has associated fold-and-fault intersections, overturning of the stratigraphy, and local quartz veining. A northwesterly trending band of Cretaceous granitoid intrusions cross the area from the Roop Lakes to the Potato Hills near Dublin Gulch, and Scheelite Dome near Highet Creek. Other major intrusions or dyke systems occur to the south in the Talbot Plateau area, and northwest of the map area towards the Clear Creek drainage (Murphy and Héon, 1994; Murphy and Roots, 1996; Roots, 1997).

MINERAL DEPOSITS

Keno-Galena Hill area

Within the Keno Hill district, there are more than 65 mineral deposits in an area 26 km long and 1 to 7 km wide (Yukon MINFILE, 1997, 105M 001). Most of the deposits, with the exception of the Sadie-Ladue vein, are confined to the Mississippian Keno Hill Quartzite (Yukon MINFILE, 1997). This quartzite is about 700 m thick, is structurally overlain by phyllite and sericite schist of the Late Proterozoic-Early Cambrian Hyland Group, and is underlain by graphitic schist, phyllite and sericite schist of the Devono-Mississippian Earn Group. Triassic metadiorite sills intrude the sequence.

The metasedimentary rocks strike east and dip 20° to 30° south. In the Keno Hill-Galena Hill area, these rocks form the south flank of the McQuesten anticline. The mineral deposits consist of mineralized vein-faults 0.3 to 30 m wide in the Keno Hill Quartzite. Metasedimentary rocks commonly show left-lateral offsets of more than 150 m across these faults, which strike northeast and dip steeply southeast. The ore zones are cut by steep unmineralized cross faults, which strike northwest and show right-lateral offsets ranging from 1 to 610 m, and by bedding-plane thrust faults which have up to 30 m of movement (Yukon MINFILE, 1997).

Mineralization consists of argentiferous galena, freibergite (argentiferous tetrahedrite), and pyrargyrite (ruby silver), along with sphalerite, pyrite and minor polybasite, stephanite, argentite and native silver. The silver to lead ratio varies from 3:1 to 11:1 depending on the tetrahedrite content. Siderite is the main gangue mineral (Yukon MINFILE, 1997).

Placer silver nuggets have been recovered on Duncan Creek, a few kilometres downstream from silver-bearing quartz veins during historic and present placer mining. Silver- and galena-bearing quartz veins on Keno Hill are likely the local source. In Thunder Gulch, the placer gold is more angular and less travelled, perhaps originating from local bedrock veins within the headwaters on the west flank of Mount Hinton (Yukon MINFILE, 1997, 105M 052). Upper Duncan, Granite and Keystone creeks also host placer gold that may have been derived from Mount Hinton. Other local gold sources include quartz veins within phyllite, grit and phyllitic schist of the Hyland Group bedrock; local stocks, veins, intrusions or hydrothermal systems associated with plutons at Roop Lakes; and locally auriferous Tombstone age dykes and sills trending approximately east-northeast throughout the district (Roots and Murphy, 1996).

Dublin Gulch/Haggart Creek area

The most important mineral deposit in the Dublin Gulch area is hosted by the Potato Hills granite stock (Yukon MINFILE, 1997, 106D 025). The Potato Hills

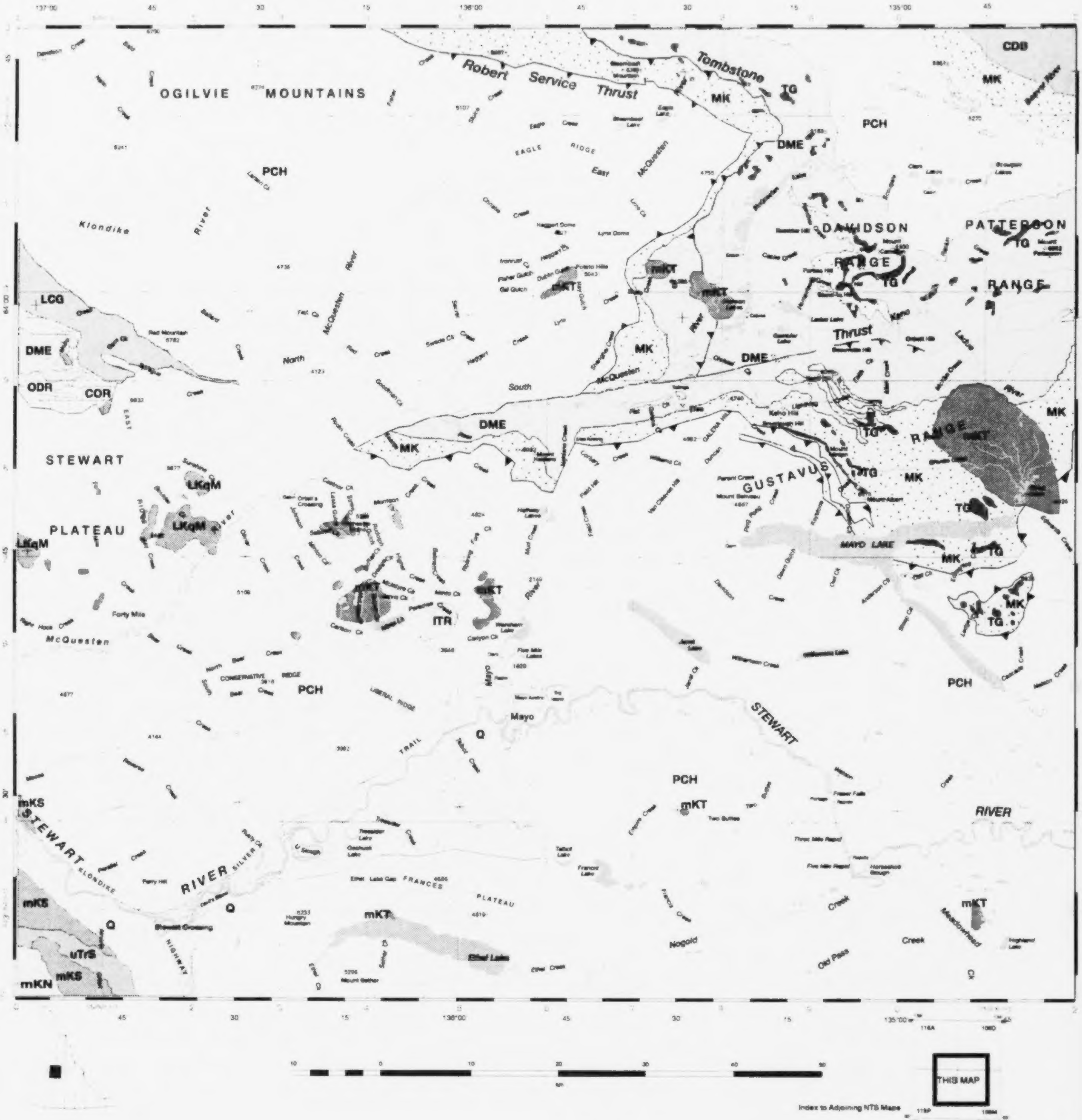


Figure 4. Generalized bedrock geology (after Roots and Murphy, 1992; legend on adjacent page).

Quaternary

Q unconsolidated glacial, glaciofluvial and glaciolacustrine deposits, fluviatile sediments and local volcanic ash.

Tertiary

lTR Ross
mixed basalt and rhyolite and terrestrial local shale, sandstone and conglomerate, dominantly along or near Tintina Fault.

Cretaceous

LKqM McQuesten Suite
biotite ± muscovite granite and quartz monzonite.

mKN Mount Nansen
andesite to dacite flows, breccia and tuff; felsic lapilli tuff; rhyolite and quartz-feldspar porphyry plugs, dykes, sills and breccia.

mKS Selwyn Suite
plutonic suite of intermediate to more felsic composition (quartz monzonite, granodiorite and granite) and rarely syenitic.

MKT Tombstone Suite
syenite, quartz syenite; minor granite, monzogranite, diorite.

Triassic

uTrS Synorogenic clastic rocks
conglomerate with clasts of basalt, chert, mylonite, limestone, foliated hornblende granodiorite and quartz monzonite.

TG Galena Suite
diorite dykes.

Mississippian

MK Keno Hill Quartzite
quartz arenite with minor black shale or carbonaceous phyllite.

Devonian-Mississippian

DME Earn Group
black siliceous shale and chert with minor felsic volcanic rocks, chert-pebble conglomerate, barite and many occurrences of stratiform Pb-Zn.

Ordovician-Devonian

ODR Road River - Selwyn
black graptolitic shale and chert overlain by argillite and dolomitic siltstone or buff platy limestone.

Cambrian-Devonian

CDB Bouvette Formation
dolomite and limestone, minor argillaceous limestone, limestone conglomerate, and black shale.

Cambrian-Ordovician

COR Rabbitkettle Formation
silty limestone and calcareous phyllite and limestone conglomerate; local mafic flows, breccia and tuff.

LCG Gull Lake Formation
dominantly shale, siltstone and mudstone with minor quartz sandstone; basal limestones (conglomerate); phyllite to quartz-muscovite-biotite schist.

Proterozoic

PCH Hyland Group
coarse turbiditic clastics, limestone and maroon and green shale; layered micaceous quartzose rock; gritty phyllite; quartzite and metaconglomerate; rare calc-silicate rock.

***Figure 4** (continued). Legend.*

stock intrudes metasedimentary rocks of the Late Proterozoic-Early Cambrian Hyland Group. The deposit consists of gold-bearing quartz veins and stockwork cutting the granite. Most veins strike northeast and range in width from a few centimetres to over 2 m, although the arsenopyrite-rich section is usually restricted to widths of 10 to 25 cm near the centre. Minor amounts of pyrite occur with the arsenopyrite (Yukon MINFILE, 1997).

The vein on the Victoria claims assayed 8.6 g/t Au and 13 g/t Ag over a width of 0.6 m for the 23-metre length of the drift. Similar assays were obtained from other veins (Yukon MINFILE, 1997).

Based on the trenching and drilling programs conducted by Amax Gold and Ivanhoe in 1991, a resource of 90 million tonnes grading between 0.93 g/t Au and 1.24 g/t Au has been identified on the Dublin Gulch property, presently owned by New Millenium Mining Ltd (Yukon MINFILE, 1997).

A tungsten skarn deposit known as Ray Gulch also occurs on the margin of the Potato Hills stock with drill-indicated reserves of 5.4 million tonnes at 0.82% WO_3 (Brown et al., 2002).

Highet Creek area

The Scheelite Dome (Yukon MINFILE 1997, 115P 004) gold-tungsten property lies at the headwaters of Highet Creek, where a porphyritic Cretaceous biotite-quartz monzonite is in contact with Hyland Group marble and amphibolite. The mineralization consists of wollastonite and actinolite skarn with disseminated pyrrhotite, scheelite and chalcopyrite (Yukon MINFILE, 1997).

The Scheelite Dome stock is cut by a shear zone 300 to 500 m wide, which extends northwest from the Hawthorne stibnite-arsenopyrite-gold quartz veins exposed in Harvey Gulch and Swede Gulch (Yukon MINFILE, 1997, 115P 003). A network of 0.5 to 5 cm wide quartz-feldspar veins, striking north and east, cuts quartz monzonite within the shear zone. Traces of arsenopyrite, molybdenite and scheelite occur along the edges of the veins (Yukon MINFILE, 1997).

A variety of other tin-silver veins and breccias, as well as several tungsten gold veins and skarns, are also associated with Cretaceous granites in the McQuesten River area (Yukon MINFILE, 1997).

SOILS AND PERMAFROST

The dominant soil in the study area is a Holocene brunisolic soil (>40%), which in central Yukon is known as the Stewart Neosol. Brunisols are poor to well-drained, yellowish-brown mineral soils that develop in forest, alpine, and tundra environments. Temperature regimes for brunisols range from temperate/cool to arctic, while moisture regimes conducive to brunisol development are generally per-humid to semi-arid (Clayton et al., 1977). The solum, or soil profile, ranges in thickness from 37 to 49 cm; it contains limited pedogenic weathering and little to no illuviated clay or other soil structures (Tarnocai et al., 1985). Other soil types in the Mayo area include cryosols (>20%) where permafrost is prevalent, and fibrisols (thick, organic-rich, weakly decomposed soils; 10 to 20% of surface area in poorly drained areas; Clayton et. al., 1977).

The Mayo area lies within the extensive discontinuous permafrost zone. Under this classification, approximately 50 to 90% of the land area is underlain by permafrost (Burn, 1994). Variations in permafrost distribution within this zone are controlled by surface sediments, soil moisture, aspect, and snow depth (Burn, 1987). Permafrost occurs typically on north- and east-facing slopes, highlands above 1372 m elevation, and poorly drained valley bottoms. Permafrost features, such as sorted stone polygons and solifluction lobes, are common near most plateau summits especially in the Gustavus Range. Open-system pingos, although rare, also occur in the Mayo area. These are large mounds of soil-covered ice, which form in part by the hydrostatic pressure of water below the permafrost. One example of pingo development is found at the headwaters of Swede Creek (Fig. 2), where two open-system pingos occur at the base of a north-facing slope. This area was last glaciated during the Reid glaciation and the surficial deposits likely consist of fine-grained material and organics derived from McConnell periglacial weathering, as well as from recent Holocene surface alluviation. Massive ice bodies such as those found in the Dawson area are rare in Mayo surficial deposits. This is attributed to the predominance of well-drained, coarse alluvium, typical within the limits of the Cordilleran glaciations.

VEGETATION

The Mayo area lies in the Mayo Lake-Ross River ecoregion within the northern boreal forest, as described by Oswald and Senyk (1977). A northern mixed deciduous and coniferous forest is dominant, but vegetation type in the study area varies strongly according to slope, aspect and surficial sediments. Black spruce (Picea mariana), paper birch (Betula papyrifera), willow (Salix sp.) and mountain alder (Alnus crispa) characterize north-facing slopes. In contrast, well drained, south-facing slopes in valley bottoms contain a mix of white spruce (Picea glauca), aspen (Populus tremuloides) and various grasses. South-facing slopes on plateaus and mountains have a denser tree growth than valley bottom sites and are dominated by white spruce, paper birch, aspen and grasses. Mountain alder, willows and white spruce occur locally along drainages. The diverse vegetation in the broad valley bottoms reflects a wide range of surficial deposits. Poorly drained alluvial and glacio-lacustrine sediment is typically vegetated by black spruce, sedges and sphagnum tussocks. White spruce, aspen, paper birch, and less commonly, lodgepole pine (Pinus contorta), dominate well-drained areas such as alluvial and glacial terraces. Subalpine regions are characterized by a mix of subalpine fir (Abies lasiocarpa), willows, dwarf birch (Betula nana L.) and mosses. Ericaceous shrubs, willows, dwarf birch, lichens and mosses are common in alpine regions. Disturbed sites are initially vegetated by fireweed (Epilobium angustifolium) and willow species.

QUATERNARY AND GLACIAL HISTORY

The Yukon has been subjected to several major episodes of glaciation, generally known as the pre-Reid (early Pleistocene), Reid (middle Pleistocene), and McConnell (late Pleistocene) glaciations. Table 3 shows simplified Late Cenozoic stratigraphy of the Mayo area.

In the central Yukon, each subsequent glaciation was progressively less extensive. The study area was completely glaciated during the pre-Reid and Reid glaciations, but only partly glaciated by the McConnell ice sheet (Fig. 3). The pre-Reid glaciation consisted of multiple episodes, the earliest being at least >2.58 Ma (Froese, 1997). Only the Reid (approximately 300 000 years ago) and the

***Table 3.** Mayo area Late Cenozoic stratigraphy (modified from Roots, 1997)*

QUATERNARY

Holocene - post-McConnell and recent

Age: <10.3 Ka (interglacial)

Organic deposits and soils, permafrost and cryoturbation deposits
soils, fenland, peat, 'muck,' pingos, thermokarst ponds and lakes, cryoturbation wedges, casts, surfaces, loads, diapirs, and cryoplanation terraces

Alluvial deposits
alluvial gulch, canyons, valley, plain, terrace, fans, deltas, lacustrine, and complexes

Colluvial deposits
colluvial veneer, felsenmeer, rock fall, talus, blanket, and complexes

Eolian deposits
eolian dunes, veneer, blanket, and complexes

PLEISTOCENE

Late Pleistocene - Late Wisconsinan-McConnell

Age: <29 - 10.3 Ka (glacial)

Glaciofluvial and glaciolacustrine deposits
alluvial outwash valley, plain, terrace, fans, eskers, fan-deltas, lake-bottom blankets, and complexes

Glacial deposits
moraine (till) ridges, hummocky stagnation moraine, veneer, blankets, and complexes

Eolian deposits
loess veneer and blanket

pre-Late Wisconsinan - pre-McConnell

<200 - 29 Ka (interglacial)

Organic deposits and soils

Alluvial deposits
alluvial gulch, valley, plain, terrace, overbank, fans, fan-deltas, lacustrine, and complexes

Colluvial deposits
colluvial veneer, felsenmeer, rock fall, talus, blanket, and complexes

Middle Pleistocene - Illinoisan-Reid

Age: <311 - >190 Ka (Huscroft et al., 2001)

Glaciofluvial and glaciolacustrine deposits
alluvial outwash valley, plain, terrace, fans, eskers, fan-deltas, lake-bottom blankets, and complexes

Glacial deposits
moraine (till) ridges, hummocky stagnation moraine, veneer, blankets, and complexes

Illinoisan - Reid (interglacial)

Organic deposits and soils

Alluvial deposits
alluvial gulch, valley, overbank

Colluvial deposits
colluvial veneer, felsenmeer, rock fall, talus, blanket, and complexes

Early Pleistocene - undifferentiated pre-Reid

Age: <2.58 Ma >1.4 Ma

pre-Reid (glacial)

Glaciofluvial and glacial deposits
alluvial outwash valley, plain, terrace, moraine (till) ridges, morainal blanket, and complexes

pre-Reid (interglacial)

Alluvial deposits
alluvial gulch, valley, overbank

Colluvial deposits
colluvial veneer, felsenmeer, rock fall, talus, blanket, and complexes

PLIOCENE- EARLY PLEISTOCENE

undifferentiated

Age: >2.58 Ma

Alluvial deposits
alluvial gulch, valley, overbank

Colluvial deposits
colluvial veneer, felsenmeer, rock fall, talus, blanket, and complexes

Cryoturbation deposits
cryoturbation wedges, casts, surfaces, loads, diapirs, and cryoplanation terraces

McConnell (approximately 20 000 years ago) glaciations have left significant surficial deposits in the Mayo area.

While the timing of the interglacial prior to the Reid is uncertain, the Koy-Yukon interglacial prior to the McConnell glaciation lasted approximately 170 000 years (Berger, 1994). The modern (Holocene) interglacial began approximately 11 000 years ago.

The build-up of ice in the Yukon consisted of glaciers originating from multiple accumulation zones in the Ogilvie, Selwyn, Pelly, Cassiar, and St. Elias Mountains. Ice from these centres combined as they followed the trend of major drainages and flowed toward the central plateau region. Ice from the Selwyn Mountains was largely responsible for glaciating the Stewart Plateau, south of, and including the Stewart River valley. Ice from the Ogilvie and Wernecke mountains glaciated the McQuesten drainage system and the Mayo Lake valley. Local alpine ice developed in the Gustavus Range and mixed with Cordilleran ice in the Duncan, Lightning and Granite creek valleys during the Reid and pre-Reid glaciations (Fig. 3).

Pre-Reid glaciations

The pre-Reid episode consisted of multiple undifferentiated glaciations that occurred between approximately 2.58 Ma and >300 Ka. In the present study, the pre-Reid ice limits were not mapped primarily because of minimal evidence of pre-Reid glaciations. Such evidence is limited to erosional scars on slopes and plateaus (Fig. 5), glacial erratics above the Reid glacial limit, and the rare exposure of pre-Reid sediments lying below Reid glacial sediments. Despite these limitations, pre-Reid diorite erratics have been found at 1370 m (4500 ft) on Steamboat Mountain and 1495 m (4900 ft) on Haggart Dome (Fig. 6). A possible pre-Reid glacial diamict was noted in the Potato Hills between 1370 m (4500 ft) and 1400 m (4600 ft) elevation. Pre-Reid erratics were also noted up to 1460 m (4800 ft) on the Potato Hills, and numerous occurrences were found at 1250 m (4100 ft) in the North McQuesten map area, south of upper Ballard Creek. The upper limit of pre-Reid erratics on Keno Hill was between 1620 m (5300 ft) and 1650 m (5400 ft). In the Gustavus Range, pre-Reid ice reached at least 1555 m (5100 ft), connecting the Granite Creek drainage with tributaries of upper Duncan Creek. Reworked pre-Reid interglacial deposits have been identified in an exposure on Dublin Gulch (Weston, 1999).

Reid glaciation

The Reid glaciation ended at least 200 000 years ago (200 Ka), and may have begun by 300 Ka, according to cold cycles recognized in oxygen isotope ratios from

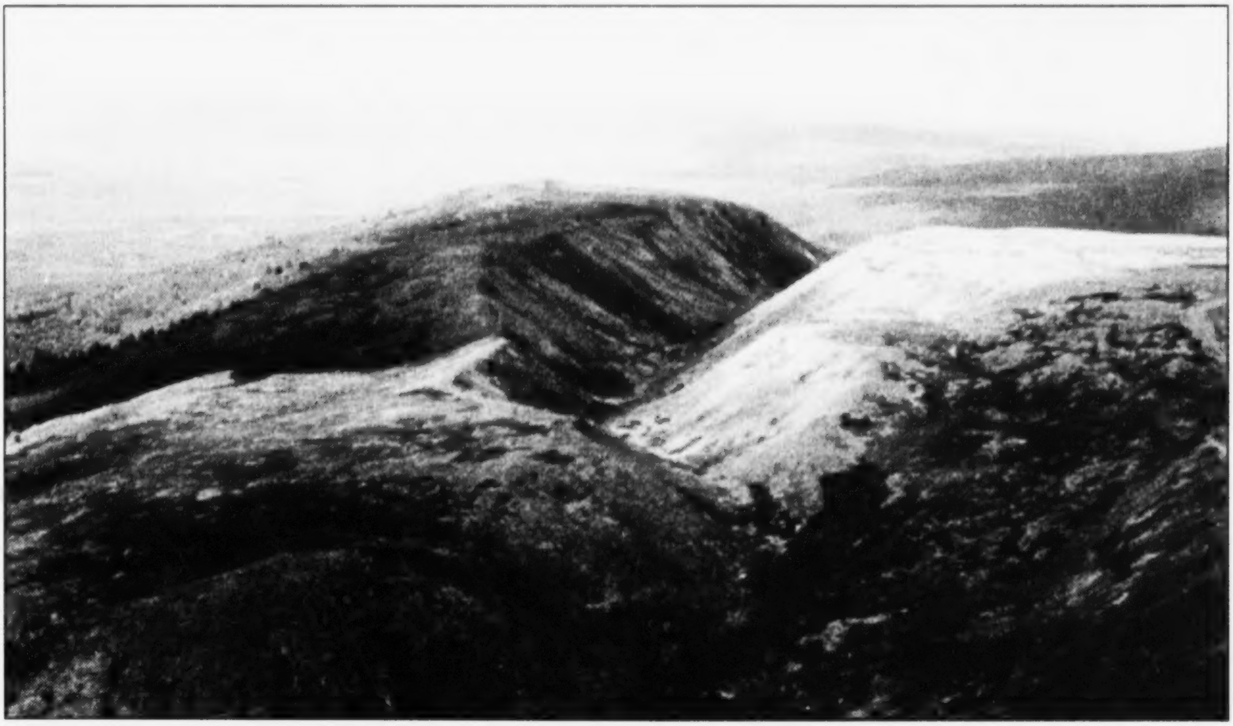


Figure 5. Meltwater channel scars are found at the tops of many hills in the Mayo area.

__Figure 6.__ Claire Wilson excavated a pre-Reid glacial erratic near Haggart Creek in 1996. Erratics are some of the limited evidence of the pre-Reid glaciations in the Mayo area.

North Atlantic deep sea cores (Barendregt and Irving, 1998). The 200 Ka date was derived from loess bracketing the Sheep Creek tephra, which overlies Reid-age glaciofluvial sediments in the Stewart River valley at the Ash Bend section (Berger, 1994; Bond, 1996). More recent investigations by Huscroft et al. (2001) give a maximum age of 311 Ka for the Reid glaciations. This is based on an Ar-Ar date from Selkirk volcanics that underlie Reid outwash. Ice-flow directions during the Reid glaciation were similar to those of pre-Reid glaciations, but in the study area the ice was at least 300 m (1000 ft) thinner during the Reid glaciation. Reid glacial landforms are better preserved than pre-Reid glacial landforms, thus permitting mapping of the Reid ice limit throughout the North McQuesten (115P/16) and Dublin Gulch (106D/4) map areas (Figs. 2 and 3, Bond, 1999, in pocket). In the Keno Hill map area, the Reid glacial limit is evident on the slopes of Galena Hill, on the west side of Keno Hill, in Duncan Creek valley, and sporadically on the north side of Mayo Lake. The Reid glacial limit is less apparent in areas of steeper terrain, such as in Gustavus Range cirques and along the south flank of the Ogilvie Mountains in Eagle Creek valley.

During the Reid glaciation, Cordilleran ice may not have reached its maximum extent at the same time as local alpine ice. The glaciers in the Gustavus Range had a smaller, more local source than the ice from the Ogilvie Mountains, making them more sensitive to climate fluctuations and resulting in a quicker response to both glacial and deglacial climate changes. When Upper Duncan Creek ice had reached its maximum northwest extent near the confluence with the main valley, Keno-Ladue ice was only just entering the area and had not yet reached its maximum level. Keno-Ladue ice advanced into upper Duncan Creek after local ice began retreating into the cirques. This timing is demonstrated by the overlapping fabrics of two glacial diamicts in upper Duncan Creek, where a local montane till was found below a till containing fabrics suggestive of an up-valley flow (F. Hein, pers. comm., 1996). Alternatively, this stratigraphic sequence may suggest that local ice and Cordilleran ice coalesced for some period until the local ice began to retreat. Cordilleran ice could then have subsequently advanced into the montane valleys of the Gustavus Range. Similarly, ice continuing down the Duncan Creek drainage would have collided with ice advancing up Duncan Creek from the Mayo River valley (Fig. 7). Where the ice lobes met is uncertain, but this blockage from the south may have encouraged ice and meltwater to flow into the headwaters of Williams Creek. High-level outwash benches preserved between the Williams Creek and Field Creek drainages support this glacial history.

__Figure 7.__ Leyla Weston and Lisa Mackinnon document the stratigraphy of an exposure on Upper Duncan Creek.

McConnell glaciation

The timing of McConnell ice in the study area remains uncertain. The McConnell glaciation had begun by 29.6 Ka according to a ^{14}C date and a paleoenvironmental reconstruction using detrital organics found below McConnell till near Mayo (Matthews et al., 1990). Ice-free conditions, however, still persisted near Ross River at 26.3 Ka (Matthews et al., 1990; Jackson and Harington, 1991). Dated organic material near Jake's Corner (south of Whitehorse) suggest McConnell ice had disappeared from the lowlands of southern Yukon by 11.3 Ka (GSC-3831, McNeely, 1991). These dates suggest the McConnell glaciation had 15 Ka to reach a maximum and then retreat back to accumulation zones.

Above the canyon on Upper Duncan Creek (just outside the McConnell ice limit), a sample of wood was ^{14}C dated at 27.4 Ka ± 220 a B.P. (Beta-109148). This sample of wood, as well as ice-wedge casts found stratigraphically higher in the section (Fig. 8), suggest that the Keno area was exposed to McConnell periglacial conditions as much as 1000 years prior to the arrival the Cordilleran ice sheet. Organic material in alluvial fan sediments on Gill Gulch, just above a paleochannel bench of Haggart Creek, was ^{14}C dated at 12.3 Ka ± 120 a B.P (Beta-109150). This suggests periglacial conditions had waned by that time, as McConnell ice had retreated far enough to allow vegetation to re-establish itself.

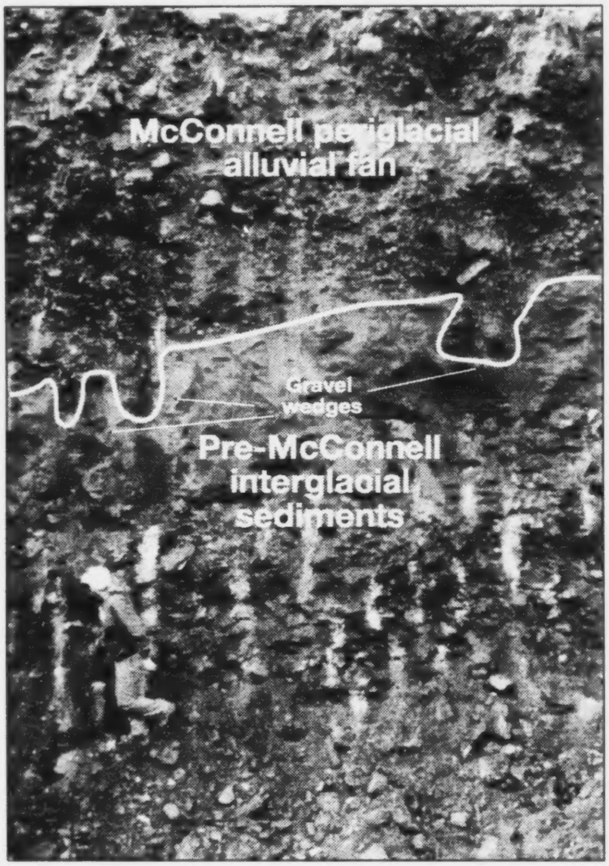

McConnell periglacial alluvial fan
Gravel wedges
Pre-McConnell interglacial sediments

Figure 8. Exposure showing sediments from a McConnell periglacial fan with gravel wedges developed into interglacial sand and gravel on Upper Duncan Creek.

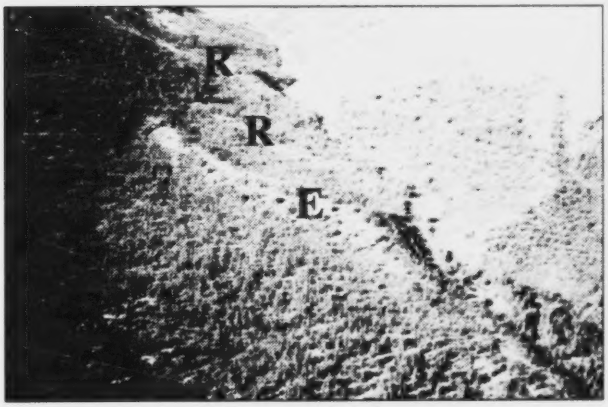


Figure 9. *Alpine moraines at the McConnell ice limit were deposited by a local cirque glacier on upper Granite Creek. R=recessional moraine; E=end moraine*

McConnell glacial landforms are easily recognized in the study area, especially in the Dublin Gulch and the Keno Hill map areas (Fig. 9; Bond, 1998d,f, 1999, in pocket). McConnell ice did not extend to the North McQuesten River map area, although meltwater deposits are present in the valley bottom. Depositional landforms are well preserved in valley bottoms and sides, particularly in moderate to gently sloped valleys aligned parallel with the regional glacial flow. Depositional landforms at the McConnell end moraines are particularly prominent throughout the Mayo area.

PALEOGEOGRAPHY

Glacial flow patterns

The pre-Reid glaciation was the most extensive and advanced the farthest into the Mayo area, glaciating most of the uplands to their summits. Few pre-Reid deposits have been identified because of erosion or burial by more recent glaciations. Pre-Reid interglacial deposits were identified in exposures at Dublin Gulch, Highet Creek and Duncan Creek, and were most commonly preserved outside or near the limits of the McConnell glaciation.

Scattered pre-Reid erratics were documented above the Reid glacial limit, however; only two pre-Reid deposits were exposed at the surface in these areas. It seems likely, considering the deep valleys, that the pre-Reid glacial ice flow was topographically controlled throughout the area. If this were the case, then it is assumed that the more recent glaciations followed a similar path.

The Reid ice sheet entered the Mayo area from the north and east (Fig. 3, Bond 1999, in pocket). The main conduits for Reid ice emanating from the Ogilvie Mountains were the McQuesten Lakes valley and the North and East McQuesten River valleys. Ice entering the Mayo area from the east originated primarily from the Selwyn Mountains, with the main conduits being the Mayo Lake area, Janet Lake valley, and the Stewart River valley. The largest valley glacier was contained in the Stewart River valley, and it advanced the furthest to the west. The McQuesten River valley was also an important conduit for ice sheets, and during the Reid glaciation, ice advanced to the Tintina Trench. The McConnell glaciation appears to have followed similar flowlines to the Reid glaciers. The important difference was that the McConnell glaciation was less extensive and terminated in the Mayo area. McConnell ice from the McQuesten Lakes and Keno-Ladue river valleys advanced to Mount Haldane, and then split into two lobes on either side of the upland; the glacier then terminated shortly after (Bond, 1999, in pocket). Ogilvie Mountain ice also advanced down the East McQuesten River valley and terminated along the east flank of Eagle Ridge (Bond, 1999, in pocket). A second major ice lobe entering the area came through the Mayo Lake system. The glacier advanced beyond the present day extent of the lake and terminated approximately 6 km west of the Duncan Creek valley. The lake owes its origins to the deposition of end moraine sediments west of the lake. Glacial lake sediments exposed at the west end of the lake suggest a lake level at the end of the last glaciation approximately 15 m above the present level. The outlet has since been downcut by the Mayo River during the present interglacial period. The Mayo area has a number of other lakes that owe their origins to excess glacial sedimentation associated with the nearby McConnell limit. These lakes include Steamboat, McQuesten, Hanson, Gambler, Halfway, Mayo, and Janet Lakes. Ice in the Stewart River valley is responsible for glaciating the Janet Lake valley during the last glaciation.

Stretching beyond the McConnell ice limit in the Mayo area are broad outwash plains, primarily in the Stewart, Mayo, and McQuesten River valleys. The outwash plains form abandoned terraces along the margins of the valleys. In the Mayo River valley, between Field Creek and Duncan Creek, the outwash plain is largely slumped where thick deposits of glacial sediments are deeply incised. Glaciolacustrine deposits may underlie the valley at that point, creating an unstable surface upon which the later till and outwash sediments were deposited.

Late Tertiary to Holocene drainage pattern

The regional drainage pattern within the Mayo Mining District is generally to the west-southwest (Fig. 2). Most water courses within the Mayo Mining District lie within the Stewart River basin except for in the northern part of Sprague Creek map area, which lies within the Klondike River drainage basin.

Prior to the last glaciation, the McQuesten drainage basin most likely included the Beaver River. It appears that glacial sedimentation in the McQuesten Lakes area and valley erosion to the east of McQuesten Lakes caused the diversion of the Beaver River into the upper Stewart River. Likewise, the Keno-Ladue River was also diverted from the McQuesten drainage basin in a similar manner. The paleo-drainage pattern of the combined McQuesten and Beaver Rivers likely followed the modern McQuesten River drainage basin. It is possible however, that this combined flow once occupied the Haldane Creek valley, to the east of Mount Haldane. Haldane Creek valley is largely oversized and the current divide into the Mayo River drainage basin at Halfway Lakes is only 200 m above the McQuesten River. The morphology of the McQuesten River drainage basin, downstream of Mount Haldane, becomes narrower and increasingly incised towards the Tintina Trench. Tributaries to this part of the McQuesten River have become noticeably incised. In the Sprague Creek map area, upper Sprague Creek and upper Forty Mile Creek were captured from the Little South Klondike River drainage basin due to the large amount of glacial erosion in the McQuesten River valley. Tributaries to the McQuesten River in this area have very steep slopes and a v-shaped morphology, which differs from the more gentle slopes in the upper Little South Klondike River drainage basin (Bond, 1999, in pocket).

The Mayo River drainage basin likely follows its pre-glacial pattern. Mayo Lake is a product of the McConnell glaciation and may not have existed during the last interglacial. Like Halfway, Janet and the McQuesten lakes, Mayo Lake developed as a result of a glacial sediment dam in the valley. The Mayo River canyon below Wareham reservoir is also a feature of the last glaciation. Stewart valley ice impinging north into the Mayo valley appears to have diverted the river into the side slope of a bordering upland, causing it to become entrenched into bedrock.

The Minto Creek drainage appears to have been captured by the Mayo River. The eastward flow of this water course into the Mayo River is anomalous to the regional southwest drainage pattern. This is supported by the trend of upper Highet Creek, which is aligned with a southwest paleo-flow into the Moose Creek drainage basin. The effects of large valley glaciers pushing into the Minto Creek drainage basin have likely eroded the paleo-divide between Minto Creek and the Mayo River. During the McConnell glaciation, ice advanced into Minto Creek and terminated just west of the valley mouth. McConnell meltwater flowed westerly into Moose Creek and temporarily rearranged the drainage picture. Following retreat of the McConnell glacier from the Mayo area, alluvial sedimentation blocked Minto creek near Minto Lake and diverted the creek into the Mayo River drainage basin.

The pre-glacial drainage pattern of the Stewart River would have been through Nogold Creek and into the Ethel Lake area. During either the Reid or McConnell glaciation, the Stewart River was diverted from the Ethel Lake valley and into the Mayo River valley, perhaps via the Frances Lake area. This suggests that the present Stewart River valley, from Mayo to Stewart Crossing, was the Mayo River valley in pre-glacial time. During the last glaciation, McConnell ice terminated at the eastern end of Ethel Lake in what is now Nogold Creek valley. As the McConnell ice stagnated in Nogold Creek valley, a meltwater channel was cut into the Watson Creek area (Fraser canyon). The meltwater channel eventually captured the Stewart River and diverted it north around the Talbot Plateau (Fig. 10).

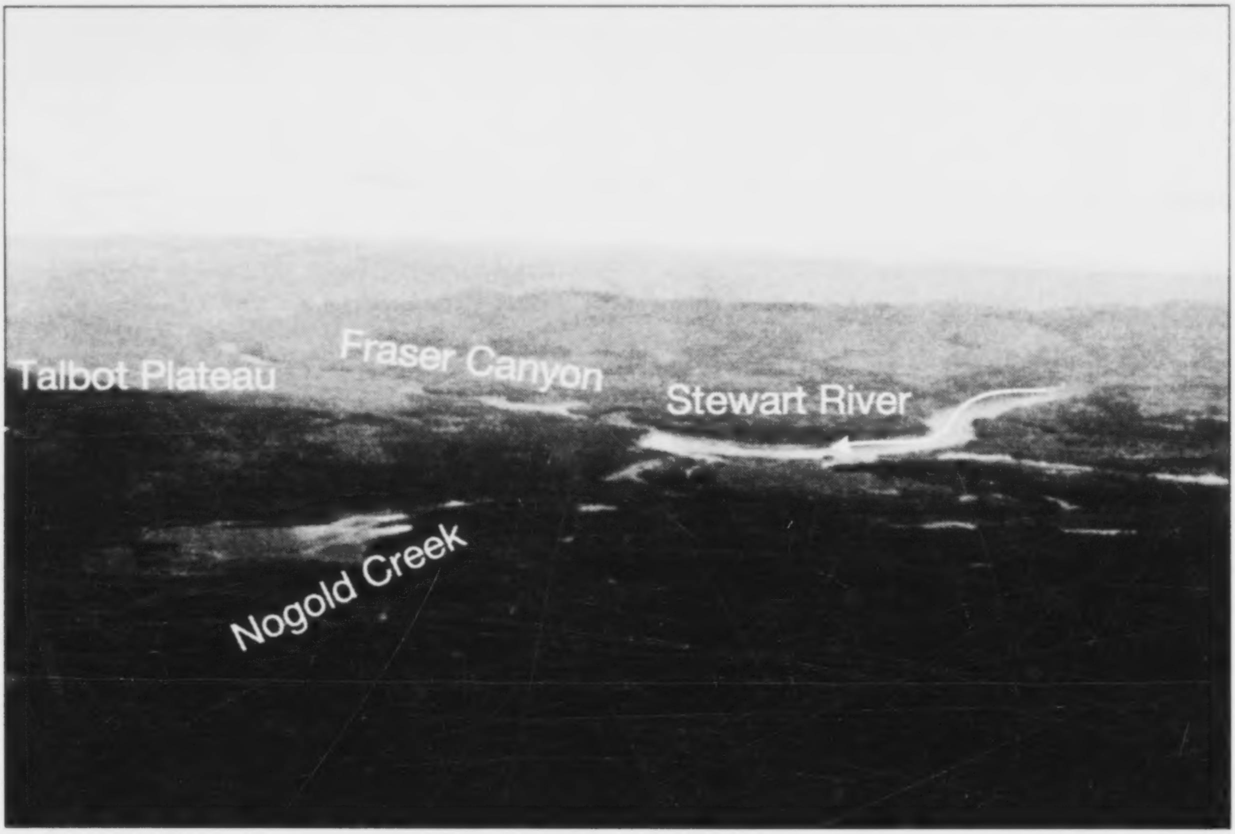


Figure 10. *The pre-glacial drainage of the Stewart River was westward in the direction of Ethel Lake. During either the Reid or McConnell glaciation, the Stewart River was diverted from the Ethel Lake valley northward into the Mayo River valley, and a meltwater channel was cut forming Fraser canyon. The meltwater channel eventually captured the Stewart River and diverted it north around the Talbot Plateau.*

SURFICIAL SEDIMENT: SEDIMENTOLOGY AND STRATIGRAPHY

In order to determine sedimentary environments and to construct paleogeographic models for an area, it is necessary to develop a classification of sediment types that incorporates the physical and biological aspects of the sediment as observed in the field. Mappable units of sediment, classified according to specific lithological, structural and diagenetic aspects, are termed 'facies.' Once the facies are identified and mapped, it is then possible to group facies into a higher order classification of facies associations or lithostratigraphic assemblages, which designate environmentally or genetically related facies. The higher order lithostratigraphic assemblages are the basis for the paleogeographic models and paleoenvironmental interpretations of the sediments, which, in turn, are the basis for understanding the geological and geomorphological evolution of a landscape through time.

The first step in understanding the paleogeographic history of an area relates to the identification and mapping of facies. In the present study, surficial sediment exposures were measured in detail, with classification into sedimentary facies after section measuring was completed. A unified facies classification for the area was developed, that incorporated the range of facies as observed in the entire study area. Although a number of criterion were used in the definition of facies (see Field and Laboratory Methodology, page 3), the major features were grain size or lithology and physical sedimentary structures. A summary of the facies scheme used in given in Table 4, which is followed by a more explicit description and interpretation of the facies. Larger scale lithostratigraphic assemblages are described and interpreted in later sections, following the basic description and interpretation of individual facies.

FACIES DESCRIPTIONS

Facies 1: Massive boulder-cobble diamict (Dmm)

Diamict is a very poorly sorted mixture of sediment that ranges widely in size from clay to boulders. These types of sediment mixtures are matrix-supported with varying amounts of clay, silt and/or sand. In the Mayo area, the diamict is massive and resistant and composed of, on average, 15-25% silt and clay and clasts generally 75-85%. Maximum boulder size is 3 m. Bed thickness ranges from 1.1 to 9.0 m. In beds with a sand-clay matrix there is a prominent blocky fracture. Diamicts with a fine sand-clay matrix tend to be more compact, tightly packed, and apparently cemented. Individual clasts within diamicts may be locally derived, very angular to subrounded; or extrabasinal erratics, that are subangular/subrounded to rounded.

In the drainage basins of Thunder Gulch, Upper Duncan and Duncan creeks, resedimented clay-intraclasts or wood debris are incorporated within the diamict units. In some cases there may have been some dewatering or liquefaction of the sediment, as shown by the occurrence of vertically oriented, iron-stained, openwork patches; by

***Table 4**. Facies scheme developed for the Mayo area.*

Facies number	Code	Facies description	Facies interpretation
1	Dmm	massive boulder-cobble diamict	lodgement till, meltout till, resedimented till
2	Dms	weakly stratified boulder-cobble-pebble diamict	debris flows, slumps, colluvial slope and solifluction deposits, resedimented till
3	Gms	weakly stratified/imbricated boulder gravel	fluvial gravel bars or diffuse gravel sheets under high traction flows
4	Ggh	graded or graded-stratified gravel	hyperconcentrated flood flows
5	Ghpt	stratified/cross-stratified gravel	high traction flows gravel bedforms
6	Sh	massive to stratified pebbly-fine sand	high traction flows upper flow regime
7	Sp	planar tabular cross-bedded pebbly to fine sand	fluvial sand bars under high traction flows
8	St	trough cross-bedded pebbly sand	high traction flows pebbly sand bedforms
9	Sr	ripple cross-bedded sand	traction flows lower flow regime, ripple bedforms
10	Fm	massive very fine sand/silt	mass wasting or windblown loess
11	Flr	laminated/rippled sand, silt and mud	suspension fallout, waning flood flows
12	Flo	massive to laminated organic silt	paleosols

the presence of fluid-escape tubes; or by prominent internal load-structures or convolute lamination. However, in general, there is a notable absence of primary sedimentary structures in this facies, with little or no reworking of sediment. In sections on Upper Duncan Creek, blocks of grey schistose bedrock are thrust up to 1.5 m into the overlying diamict units. Colour of the diamict is generally a tan, buff or yellowish-grey.

Heavy-mineral accessories include gold, pyrite, ilmenite, garnet and magnetite with a trace of zircon. Although heavy-mineral yields tend to be low, locally, for example in Upper Duncan Creek, gold concentrations are economic.

Facies 1 is commonly in contact with bedrock or it may occur higher upsection, such as in Duncan and Highet creeks. It occurs as isolated occurrences on bedrock at the base of an alluvial fan sequence in Upper Duncan Creek (Fig. 11); on bedrock on Haggart Creek and Dublin Gulch; and as other isolated occurrences within glacially-modified valleys in the Gustavus Range, Stewart Plateau and Ogilvie Mountains.

Facies 2: Weakly stratified boulder-cobble-pebble diamict (Dms)

This facies is distinguished from Facies 1 (massive boulder-cobble diamict - Dmm) by the presence of a weak, poorly defined, parallel stratification, and rarely the occurrence of convolute lamination along with inverse grading at the base of the diamict unit. As with Facies 1, these types of sediment mixtures are matrix-supported with varying amounts of clay, silt and/or sand. The matrix in the diamict comprises coarse sand (35-40%), granules (30-40%), fine sand (5-25%), medium sand (5-10%), and silt and clay (5-10%). Individual clasts within diamicts are locally derived and very angular to angular, or more widely travelled, subangular/subrounded to rounded. Maximum boulder size is 1.5 m. Bed thickness ranges from 1.1 to 9.5 m. Clasts are disorganized, or with a notable vertical to near-vertical fabric. Weak diffuse stratification occurs as banding that is parallel and, where discernable, is coincident with local slope directions. Individual beds may be ungraded, or inversely graded

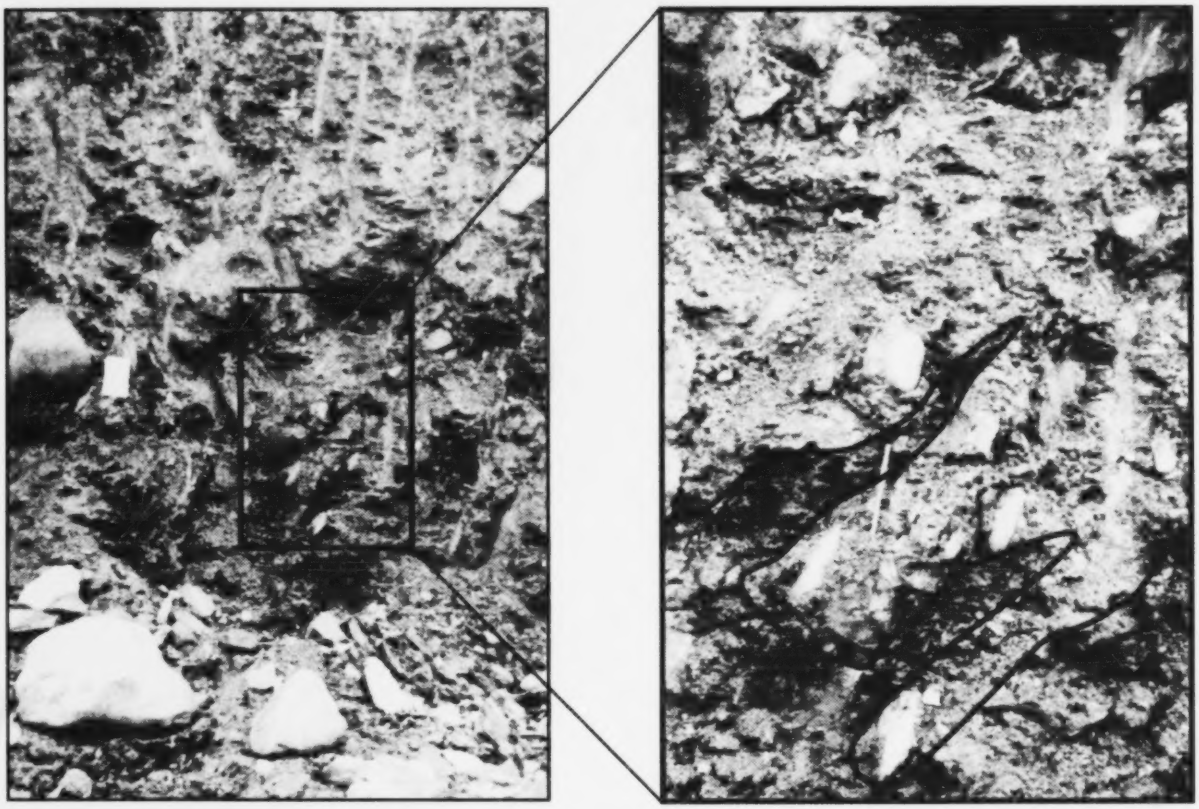


Figure 11. *Facies 1 - Dmm, massive boulder cobble diamict, occurs throughout the study area, commonly in contact with bedrock. The above photos from measured section UD9703 on Upper Duncan Creek illustrate the massive, compact and disorganized nature of this facies. Bedrock slivers intrude the unit at the basal contact. This example is interpreted to be either a lodgement till or resedimented lodgement till of Reid age. Field notebook in left photo is 18 cm long.*

(coarsening-upwards). The basal and topmost contacts of weakly-stratified diamict are abrupt and non-gradational. Locally the base of individual diamicts may be wavy and loaded into the underlying material. Colour of the diamict is variable, generally a function of the colour of the underlying bedrock and the colour of locally derived clasts. Clast lithologies are variable, containing predominantly local bedrock lithologies, including quartz-mica schist, vein quartz, quartzite, metasandstone; and more distantly derived intrusive rocks and banded ironstones.

Heavy-mineral accessory occurrences are extremely variable, ranging from those that are barren to units that include gold, magnetite, ilmenite, and traces of scheelite, zircon and cassiterite. Heavy-mineral yields, when they occur, are variable, from low to moderate. Locally, gold concentrations in the stratified diamict may be economic where the diamict directly overlies gold-bearing veins in bedrock, or where it overlies and reworks paleoplacer deposits. Such occurrences have been noted in the following valleys: Highet Creek, Parent Creek, Gill Gulch, Haggart Creek, Ledge Creek, Hope Gulch, Seattle Creek, as well as benches along Upper Duncan Creek.

Weakly stratified diamict occurs along the basal unconformity with bedrock or higher upsection. This facies directly overlies bedrock at Seattle Creek (Fig. 12); sits on bedrock or occurs higher upsection in Duncan Creek and Highet Creek; is downvalley from bedrock canyons that feed fan-deltas along Mayo Lake, for example, Ledge Creek; is the basal unit of prograding side-valley alluvial fans in Hope, Faith, Crystal, Gill gulches, Parent and Williams creeks, on and across from Forty Pup; may be isolated as aprons flanking bedrock benches in Upper Duncan Creek and on Galena Hill; is associated with Facies 1 (massive diamict - Dmm) within cirques cut in bedrock or within glacially-modified valleys, such as Thunder Gulch and other drainages in the Gustavus Range; and may occur higher upsection associated with glaciolacustrine sediment in the Upper Duncan, Minto and Haggart creek areas.

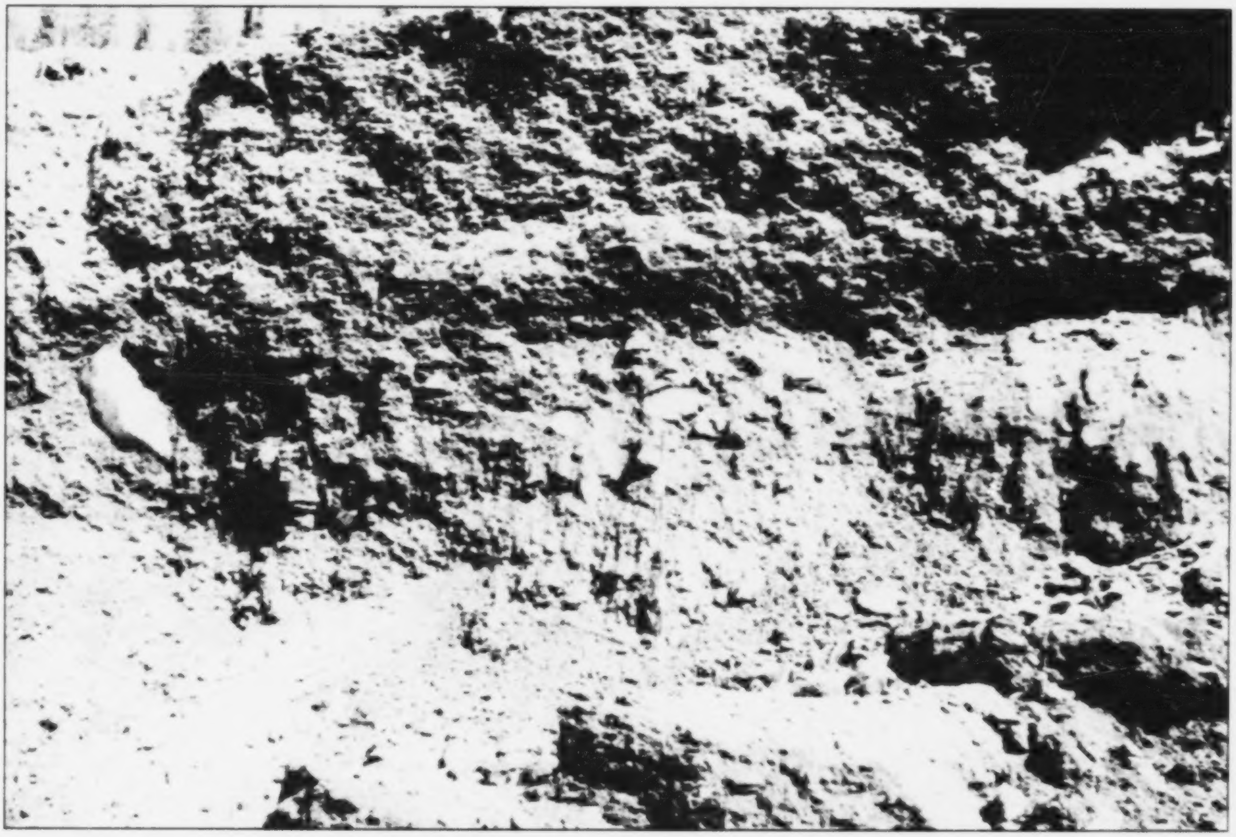


Figure 12. *Facies 2 - Dms, weakly stratified boulder cobble-pebble diamict, is similar to Facies 1, but distinguished by weak parallel stratification which follows the inclination of the slope. Clasts are somewhat disorganized and may be vertical in orientation. On measured sections SEA9701 and SEA9702 on Seattle Creek, Facies 2 is interpreted to be a periglacial debris flow, which marks the onset of the McConnell glaciation.*

Facies 3: Weakly stratified/imbricated boulder gravel (Gms)

This facies differs from Facies 1 (massive diamict - Dmm) with the presence of a variable, poorly to moderately defined, parallel stratification, along with a well-defined clast fabric (imbrication), and a general lack of fine sediment content (clay content 1-2%). Gravel of Facies 3 are clast-supported, consisting of pebble- to cobble-sized clasts with rare boulders. Imbrication is variably developed, poor in coarser-grained lower bed portions, to moderate and well developed in finer, upper bed portions. Sorting is poor to moderate. Matrix-infill between clasts contains very little clay-size material, predominantly coarse sand and granule-size material. In most cases individual clasts within the gravel is locally derived and subangular to well rounded. Less common are scattered boulders of angular, locally derived bedrock. Maximum clast size is 3 m, although these boulders are rare and always rest on bedrock. Bed thickness ranges from 0.5 to 15 m. Clasts are poorly to very well organized, or with a notable b- (intermediate) axis imbrication. Stratification is better defined than in Facies 2 (stratified diamict - Dms). In this facies the crude stratification is defined by variations in clast size, or by discontinuous, rippled sand lenses (<50 cm thick). Less commonly are ice-wedge casts and reworked organic debris. The basal contacts are abrupt and erosional, with upper bed contacts either abrupt or gradational. Colour of the gravel is variable, generally a function of the colour of the underlying bedrock, the colour of locally derived clasts, and/or dependent upon the presence of Fe- and/or Mn-staining within matrix surrounding the clasts. Lithologies consist of local quartzite and diorite, sandstone, limestone, quartz-mica schist, vein quartz, metasandstone, phyllite and rare conglomerate. Local organic detritus may be recovered from gravel, and ice-wedge casts occur locally, most notably in the Duncan Creek area.

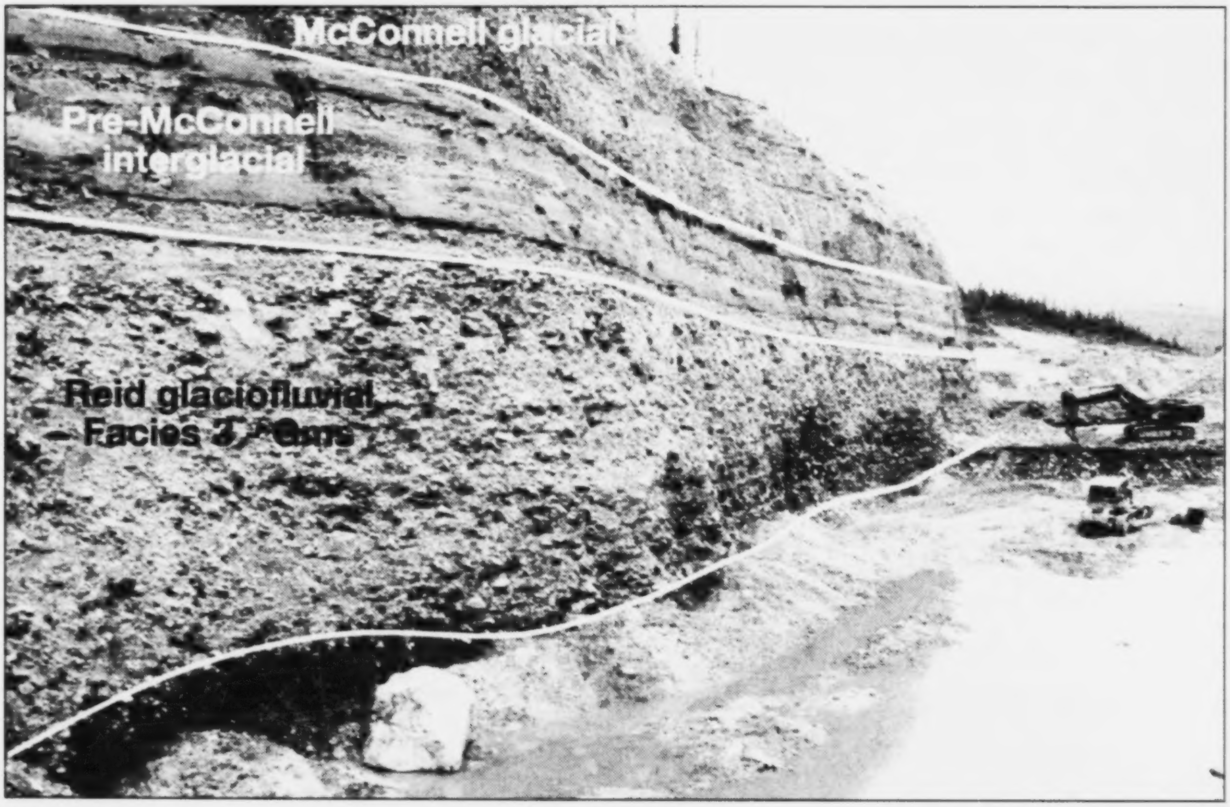


Figure 13. Facies 3 - Gms, weakly stratified/imbricated boulder gravel, is commonly crudely stratified with moderate to well-developed b-axis imbrication. Parallel stratification is defined by variations in clast size and localized discontinuous sand lenses. On Duncan Creek, this facies is the main pay gravel, with grades throughout but increasing with proximity to bedrock. This photo shows measured sections FT2-95 and FT3-95, where Facies 3 is interpreted to be a Reid outwash gravel buried by interglacial alluvium and McConnell glacial drift.

Heavy-mineral accessory occurrences are extremely variable, ranging from those that are barren to units that include gold, native silver, hematite, magnetite, garnet, pyrite, ilmenite, cassiterite and traces of scheelite or zircon. Heavy-mineral yields, when they occur, are variable, from low to high. Locally, gold concentrations in the weakly stratified gravel may be economic where the gravel directly overlies gold-bearing bedrock veins, or incorporates pre-existing sediments such as paleoplacers deposits. This facies is the main pay unit on Duncan Creek, where gold concentrations occur throughout but increase in grade near bedrock (Fig. 13).

Weakly stratified/imbricate gravel occurs along the basal unconformity with bedrock or higher upsection. This facies is associated with most landforms, including glacial moraines and meltwater channels; alluvial canyons and valleys, side-entry alluvial fans and fan-deltas. Such occurrences have been noted in most of the study area, with the more economic occurrences in the following valleys: Anderson, Davidson, Dirksen, Duncan, Upper Duncan, Empire, Haggart, Highet, Goodman, Ledge, Lightning, Minto, Rodin and Seattle creeks; Gill and Thunder gulches. Other potentially economic high-bench gravel deposits of this facies are in the valleys of Upper Duncan, Duncan and Upper Davidson creeks.

Facies 4: Graded or graded-stratified gravel (Ggh)

This facies differs from Facies 3 (weakly stratified boulder gravel - Gms) with the occurrence of normal grading (fining-upsection). Beds of this facies may also be horizontally stratified. Gravel of Facies 4 is clast- or matrix-supported, consisting of pebble- to cobble-sized clasts with rare boulders. Imbrication is variably developed, poor in coarser grained lower bed portions to moderate and well developed in finer upper bed portions. Sorting is very poor to poor. Matrix-infill between clasts is a very poorly sorted mixture of sand-silt-clay, or is sand-dominated. In most cases, individual clasts within the

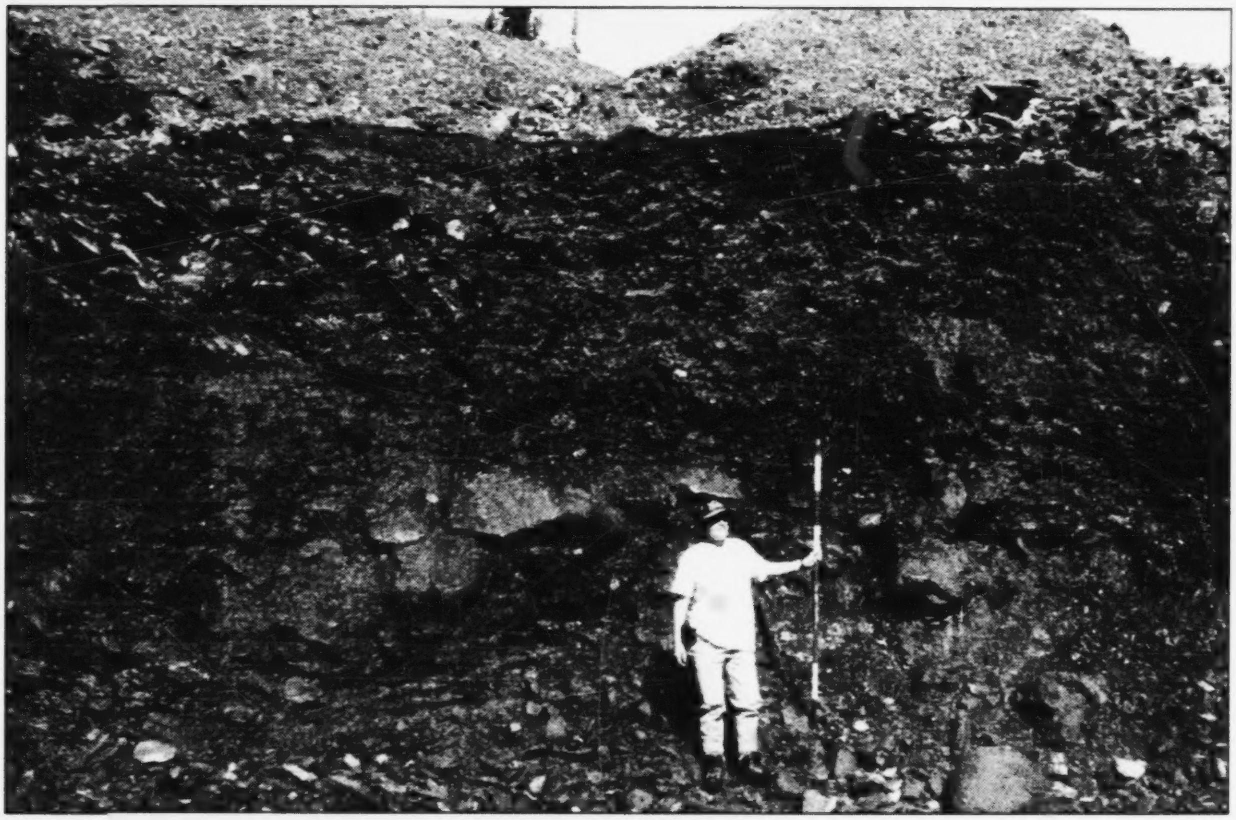


Figure 14. *Facies 4 - Ggh, graded or graded stratified gravel, is distinguished by normal (fining upward) grading. It can be matrix or clast-supported with variably developed a- or b-axis imbrication. On Rudolph gulch this facies is the main pay gravel. This photo shows measured section RUD9701, where Facies 4 is interpreted to be a Holocene gulch gravel. Each division on the pole is 20 cm.*

gravel are locally derived and subangular to subrounded, with the smaller clasts being more angular, and the boulders subrounded. Maximum clast size is 1.5 m. Bed thickness ranges from 0.5 to 1.9 m. Clasts are moderately organized, with a notable a- (long) axis imbrication or near-vertical orientation. Stratification is better defined than in Facies 2 (stratified diamict – Dms). In this facies the stratification is defined by variations in clast size, or by alternations of clast- and matrix-supported layers. Less common are ice-wedge casts and reworked organic debris. The basal contacts are abrupt and erosional, with upper bed contacts either abrupt or gradational. Colour of the gravel is variable, but it is generally a function of the colour of locally derived clasts and matrix. Lithologies consist of local quartzite and diorite, sandstone, limestone, quartz-mica schist, vein quartz, metasandstone, with phyllite and rare conglomerate.

Heavy-mineral accessory occurrences are extremely variable, ranging from those that are barren to units that include traces of gold, along with magnetite, garnet, pyrite, ilmenite, and traces of scheelite or zircon. Depending upon local bedrock mineralization, ilmenite may dominate the heavy-mineral concentrates. Heavy-mineral yields vary from low to high. Locally, gold concentrations in the graded/stratified gravel may be economic where the gravel directly overlies gold sources such as bedrock veins or has reworked paleoplacer deposits. This facies overlies the main pay unit on Highet Creek and accessories within the graded-stratified gravel are dominated by ilmenite. Pay gravel of this facies occur in Rudolph Pup, where flat gold was recovered at the base of the unit (Fig. 14), and from Empire Creek, where very large gold nuggets (up to 10 oz, 300 g) were found in this basal unit sitting on bedrock.

Graded-stratified gravel occurs along the basal unconformity with bedrock. It is a rare facies, and has only been mapped along the upper tributaries of Haggart Creek, along the flanks of Galena Hill, at Rudolph Pup, and at Empire Creek. Despite this rare occurrence, its close association with the basal unconformity along bedrock, along with recovered gold in a few cases, suggests that locally significant pay may be recovered from this facies. It must be noted that a very similar facies of gravel contained significant placer gold at Trail Hill in the Klondike area (cf. Morison and Hein, 1987; Morison, 1989). This facies may have similar economic potential, however it is a relatively unexplored unit in the Mayo district.

Facies 5: Stratified/cross-stratified boulder-pebble gravel (Ghpt)

This facies differs from Facies 4 (graded/graded-stratified gravel - Ggh) with the occurrence of well-defined stratification and cross-stratification, and a general lack of fine sediment content. This facies consists of clast-supported, cobble-pebble gravel with 75-80% clasts and 20-25% matrix. In general units are clast-supported; less commonly they are matrix-supported. The matrix is mainly coarse granule (33-65%) to coarse sand (26-49%), with lesser amounts of fine-grained sand, and rare silt/clay fines. The gravel ranges from tightly packed, compact units to loose, openwork gravel. Imbrication is moderately to well developed. Sorting is moderate to excellent. In most cases, the larger clasts within the gravel is subrounded to rounded, with the smaller clasts being somewhat more subangular to rounded. Maximum clast size is 2.5 m. Bed thickness ranges from 1.0 to 7.5 m. Clasts are moderately to well organized, with a notable b- (intermediate) axis imbrication, or less commonly an a- (long) axis imbrication for the smaller clasts. Stratification is well defined. Planar tabular and trough cross-stratification is less common. In this facies the stratification/cross-stratification mainly is defined by variations in clast size, or, less commonly, by alternations of clast- and matrix-supported layers. Ice-wedge casts and reworked organic debris occur locally. The basal contacts are abrupt and erosional, with upper bed contacts either abrupt or gradational. Colour of the gravel is typically a light to medium grey, but is also dependent upon the colour of locally-derived clasts and matrix. Lithologies consist of local quartzite and diorite, sandstone, limestone, quartz-mica schist, vein quartz, metasandstone, with more distantly derived sedimentary rocks including phyllite, conglomerate, and banded ironstone.

Heavy-mineral accessory occurrences are extremely variable, ranging from those that are barren to units that include traces of gold, magnetite, garnet, pyrite, and traces of hematite and ilmenite. Heavy-mineral yields vary from low to high. Locally, gold concentrations in the well-stratified/cross-stratified gravel may be economic where the gravel has reworked paleoplacers or overlies bedrock gold sources such as veins. This facies overlies the main pay unit on Duncan Creek (Fig. 15). At Minto and Seattle creeks, pay gravel of this facies were found in this basal unit sitting on bedrock. In test pits along Minto Creek, the gold is flat and concentrated along the base of the unit, sitting on top of bedrock.

Well-stratified/cross-stratified gravel occurs along the basal unconformity with bedrock or higher upsection. This facies is very common in the Mayo district, and is associated with fluvial and glaciofluvial landforms, including meltwater channels, alluvial canyons and valleys, side-entry alluvial fans and fan-deltas. Such occurrences have been noted in most of the study area, with the more common occurrences in the following valleys: Anderson, Davidson, Dirksen, Duncan, Upper Duncan, Haggart, Highet, Ledge, Minto, Seattle creeks and Thunder Gulch.

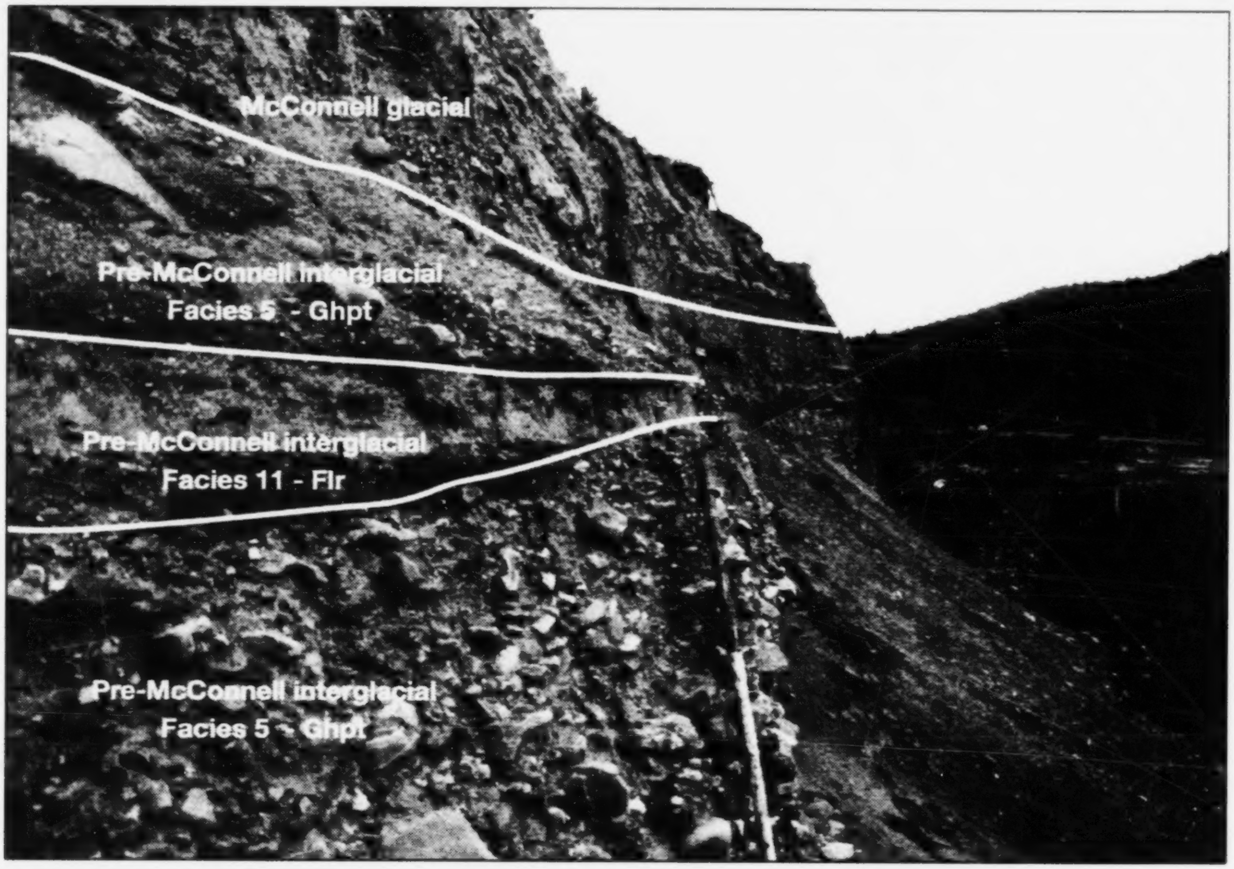

McConnell glacial
Pre-McConnell interglacial
Facies 5 - Ghpt
Pre-McConnell interglacial
Facies 11 - Flr
Pre-McConnell interglacial
Facies 5 - Ghpt

Figure 15. *Facies 5 - Ghpt, stratified/cross stratified boulder pebble gravel is overlain by Facies 11 - Flr (laminated and rippled sand, silt and mud) at this locality on Duncan Creek (measured section FT2-95), forming a fluvial channel gravel/overbank silt (fining upward) couplet. This is interpreted to be an interglacial alluvial sequence deposited between Reid glaciofluvial outwash and McConnell glacial drift. Divisions on pole are 50 cm.*

Facies 6: Massive to stratified pebbly fine sand (Sh)

This facies consists of horizontally stratified pebbly fine sand with less common massive pebbly medium sand interbeds. Sorting is moderate to excellent. Maximum bed thickness is approximately 0.5 m. This is a relatively rare facies, and is commonly associated with Facies 7 (cross-bedded pebbly fine sand - Sp) described below. Although it is a rare facies, it is important because it can help us interpret many of the other more massive gravel units, of which this facies is a small component. In addition, much of the recovered woody material is preferentially better preserved in the finer sand facies, and thus affords an opportunity for ^{14}C dating. No heavy minerals were recovered from this facies. Accessories include woody material and organic laminations. Figure 16 shows a woody sample within a massive medium sand on Duncan Creek, which was radiocarbon dated at 32 320 a ± 1270 a B.P. (Beta-86851). A similar sample found within a stratified pebbly medium sand on Upper Duncan Creek was radiocarbon dated at 27 440 a ± 220 a B.P. (Beta-109148).

Thin interbeds of this facies are common in most sections with the reworked stratified diamict (Dms) or the stratified boulder-cobble-gravel (Gms) facies. Thicker accumulations of this facies are less common, and occur in areas with a better preserved interglacial or glaciofluvial section. These include: lowermost stratigraphic units at Highet Creek; middle stratigraphic units at Duncan Creek and Thunder Gulch; higher stratigraphic units in Seattle, Goodman, and Upper Duncan creeks; and, interbedded throughout the section at Rodin Creek.

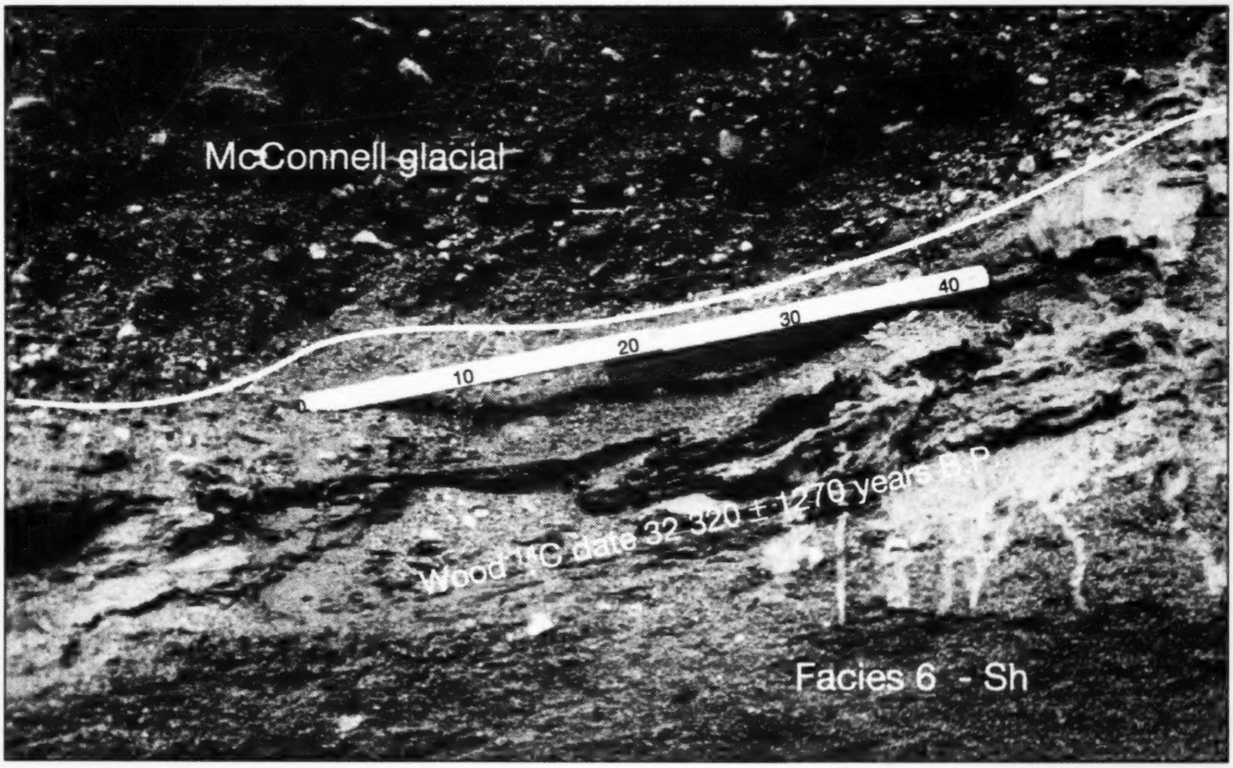


Figure 16. *Facies 6 - Sh, massive to stratified pebbly fine sand, consists of horizontally stratified pebbly fine sand with less common massive pebbly medium sand interbeds. Sorting is moderate to excellent. This photo from measured section FT95-2 (Duncan Creek), shows a sample of wood within a massive medium sand which was radiocarbon dated at 32 320 a ± 1270 a B.P. (Beta-86851). Scale is in centimetres.*

Facies 7: Planar tabular cross-bedded pebbly fine sand (Sp)

This facies consists of planar tabular cross-bedded pebbly fine sand. Sorting is moderate to excellent. Maximum bed thickness is approximately 0.5 m. This is a relatively rare facies, and is commonly associated with the previous Facies 6 (massive-stratified pebbly fine sand - Sh) described above. As with Facies 6, although it is a rare facies, Facies 7 is important because it can help interpret many of the associated more massive gravel units. No heavy minerals were recovered from this facies.

Thin interbeds of this facies are common in most sections with well-stratified boulder-cobble-gravel (Ghpt) facies. Thicker accumulations of this facies are less common, and occur in areas with better preserved interglacial or glaciofluvial sections. These include lowermost stratigraphic units at Rodin Creek (Fig. 17) and Highet Creek and middle stratigraphic units at Duncan Creek and Thunder Gulch.

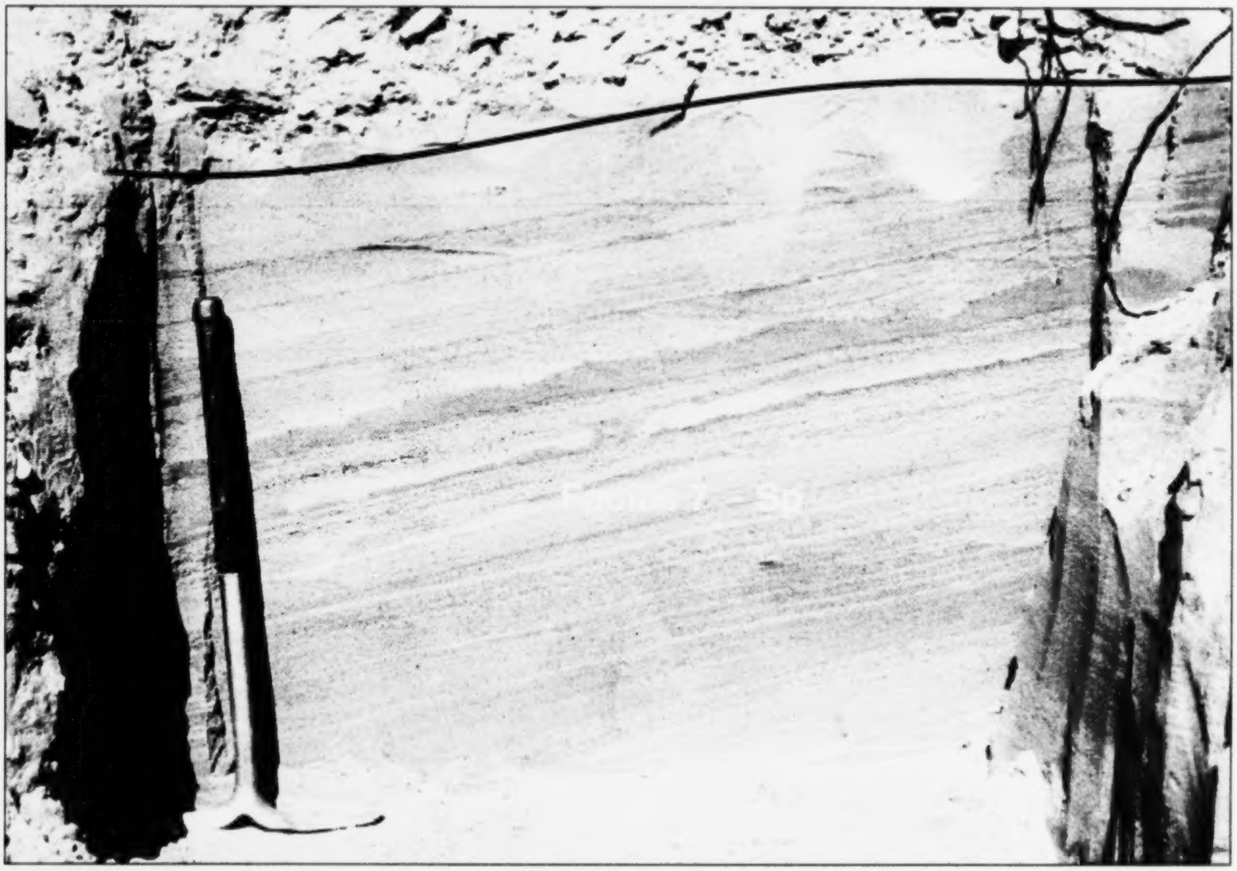


Figure 17. Facies 7 - Sp, planar tabular cross-bedded pebbly fine sand, consists of planar tabular cross-bedded pebbly fine sand. Sorting is moderate to excellent. Maximum bed thickness is approximately 0.5 m. Thick accumulations of this facies may occur in proglacial or deltaic glaciofluvial paleoenvironments, such as at this section at Rodin Creek (measured section ROD97-01).

Facies 8: Trough cross-bedded pebbly fine sand (St)

This facies consists of trough cross-bedded pebbly fine sand. Sorting is moderate to excellent. Maximum bed thickness is approximately 0.5 m. This is a relatively rare facies, and is commonly associated with the previous Facies 6 (massive-stratified sand) and Facies 7 (planar-tabular cross-bedded sand) described above. As with these other rare sand facies, Facies 8 is important because it helps in paleoenvironmental interpretation. No heavy minerals were recovered from this facies.

Thin interbeds of this facies may occur in some sections associated with well-stratified boulder-cobble-gravel (Ghpt) facies, and with ripple cross-bedded medium to fine sand (Facies 9). This unit occurs in middle stratigraphic units on Seattle Creek, Duncan Creek (Fig. 18) and Upper Duncan Creek.

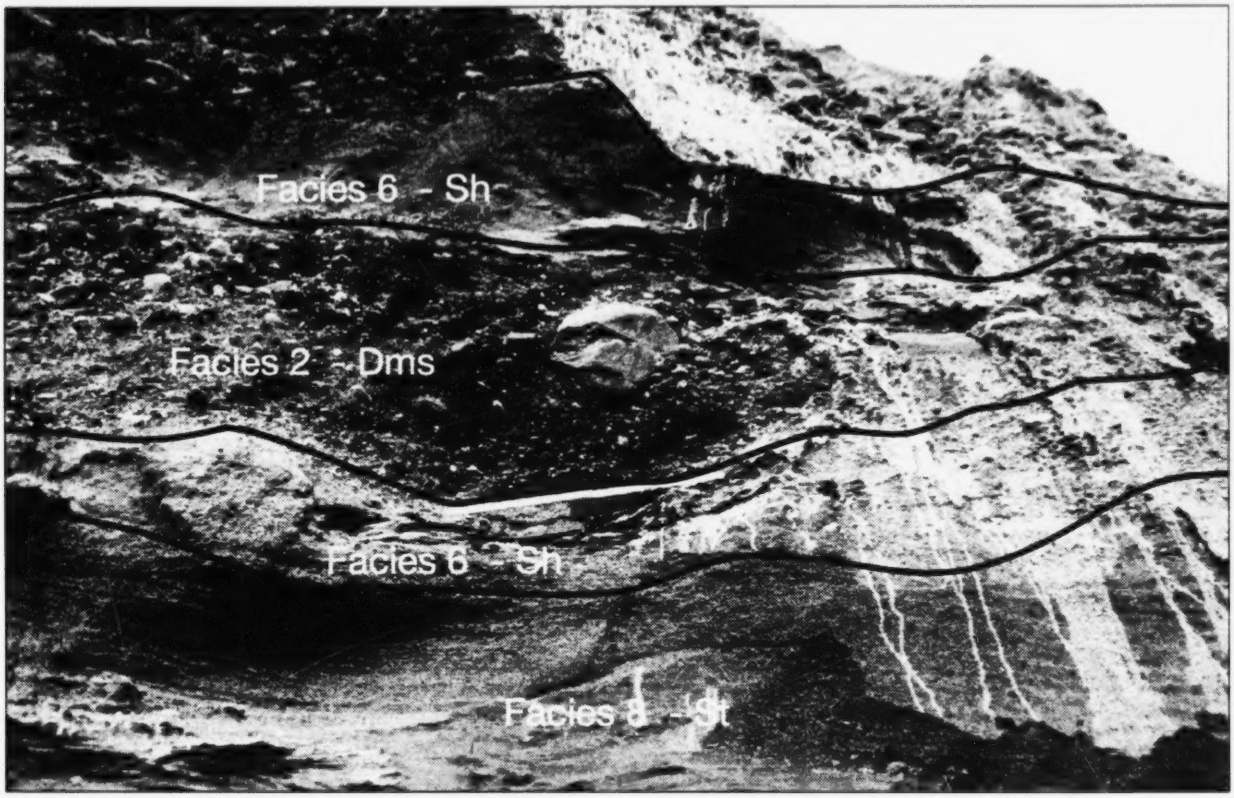


***Figure 18.** Facies 8 - St, trough cross-bedded pebbly fine sand and Facies 6 - Sh, massive to stratified pebbly fine sand may occur together, such as in measured section FT2-95 on Duncan Creek. Facies 6 reflects more rapid deposition and higher flow rates than Facies 8, which is deposited under waning tractive flow conditions. This is common in fluvial interglacial settings, which is the interpretation of this part of the exposure.*

Facies 9: Ripple cross-bedded medium to very fine sand (Sr)

This facies consists of ripple cross-bedded medium to very fine sand. Sorting is moderate to excellent. Maximum bed thickness is approximately 0.25 m. This facies is commonly associated with the previous Facies 6 - 8 (stratified and cross-bedded sand) described above. As with these other rare sand facies, Facies 9 is important to aid in paleoenvironmental interpretation, and in recovery of woody and organic material for biostratigraphic and absolute age dating. No heavy minerals were recovered.

This facies was noted in those areas with better preserved fine-grained interglacial sections and some glaciofluvial sections, including Rodin Creek, Duncan Creek and Seattle Creek (Fig. 19).

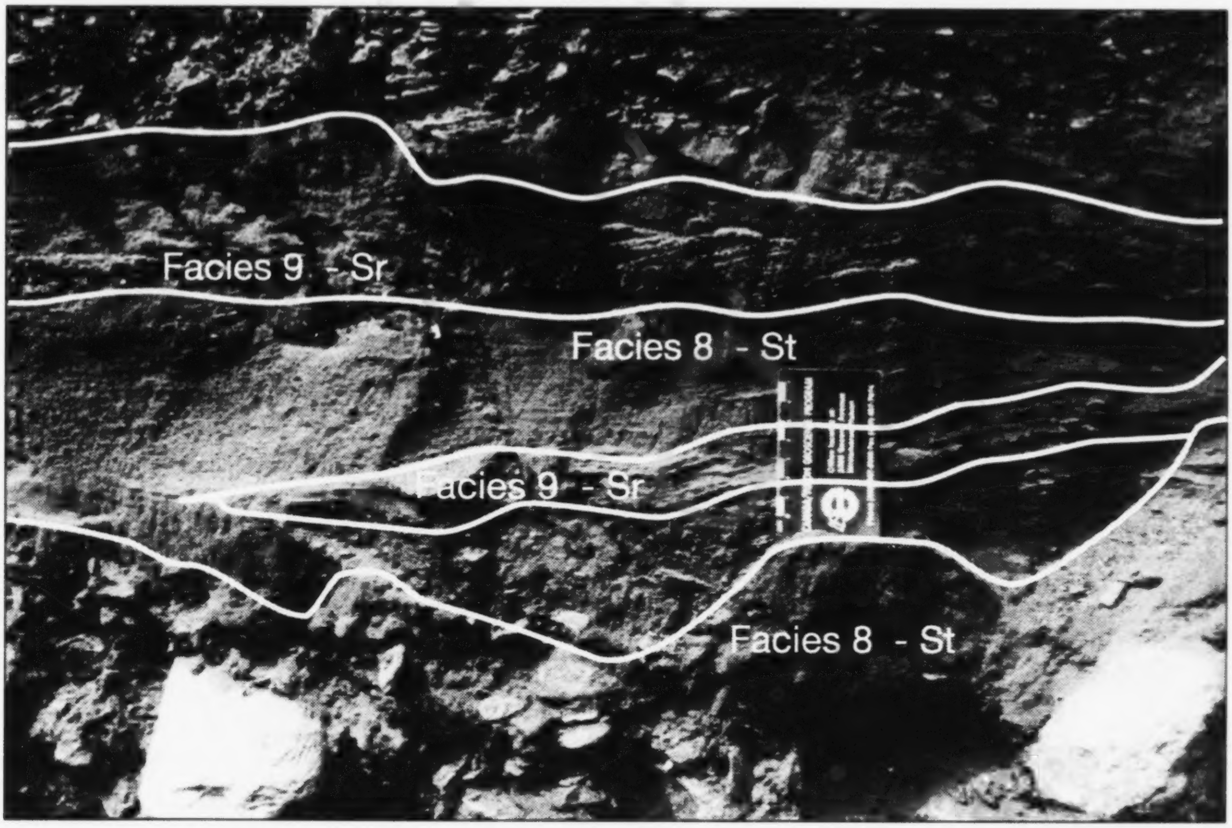


Figure 19. *Facies 8 - St, trough cross-bedded pebbly fine sand and Facies 9 - Sr, ripple cross-bedded medium to very fine sand commonly occur together, such as in this measured section SEA 9704 on Seattle Creek. A transition from Facies 8 to Facies 9 is interpreted as a reflection of gradually declining tractive flow. This type of depositional environment is more common in fluvial or distal alluvial fan systems than in glaciofluvial settings.*

Facies 10: Massive very fine sand/silt (Fm)

This facies consists of massive very fine sand/silt. Sorting is moderate to excellent. It is difficult to discern individual beds in this facies, but maximum thickness of this unit is over 5.0 m. Dispersed woody debris for finely comminuted organics occur within the massive sand/silt of this facies. Ice-wedge casts commonly occur in this facies. Colours of units from this facies vary from buff-tan grey, or light olive grey, dusky yellow, and yellowish grey, depending upon the composition of clasts and matrix, and the percentage of admixed organics.

Locally the massive very fine sand/silt facies grades vertically and laterally into Facies 1 or 2 massive or weakly stratified boulder-cobble diamict (Dmm, Dms). Massive very fine sand/silt is also associated with Facies 11 laminated and rippled fine sediment (Flr), and Facies 12 massive organic-rich silt (Fo). This unit was not studied in detail, and only sampled for heavy minerals in one or two cases. Heavy mineral yield is low, but garnet and ilmenite are present along with traces of magnetite and cassiterite. No gold was recovered from this facies.

This facies was noted in those areas with aeolian and mass-flow deposits, commonly with lacustrine, proglacial or glaciolacustrine sections. These include middle stratigraphic units at Ledge Creek and topmost stratigraphic units at Duncan Creek, Seattle Creek and Highet Creek (Fig. 20).

Facies 11: Laminated and rippled sand, silt and mud (Flr)

This facies consists of stacked units of sand, silt and mud that are planar laminated with common to rare rippled interlaminae. Silt is more dominant near the bottom of

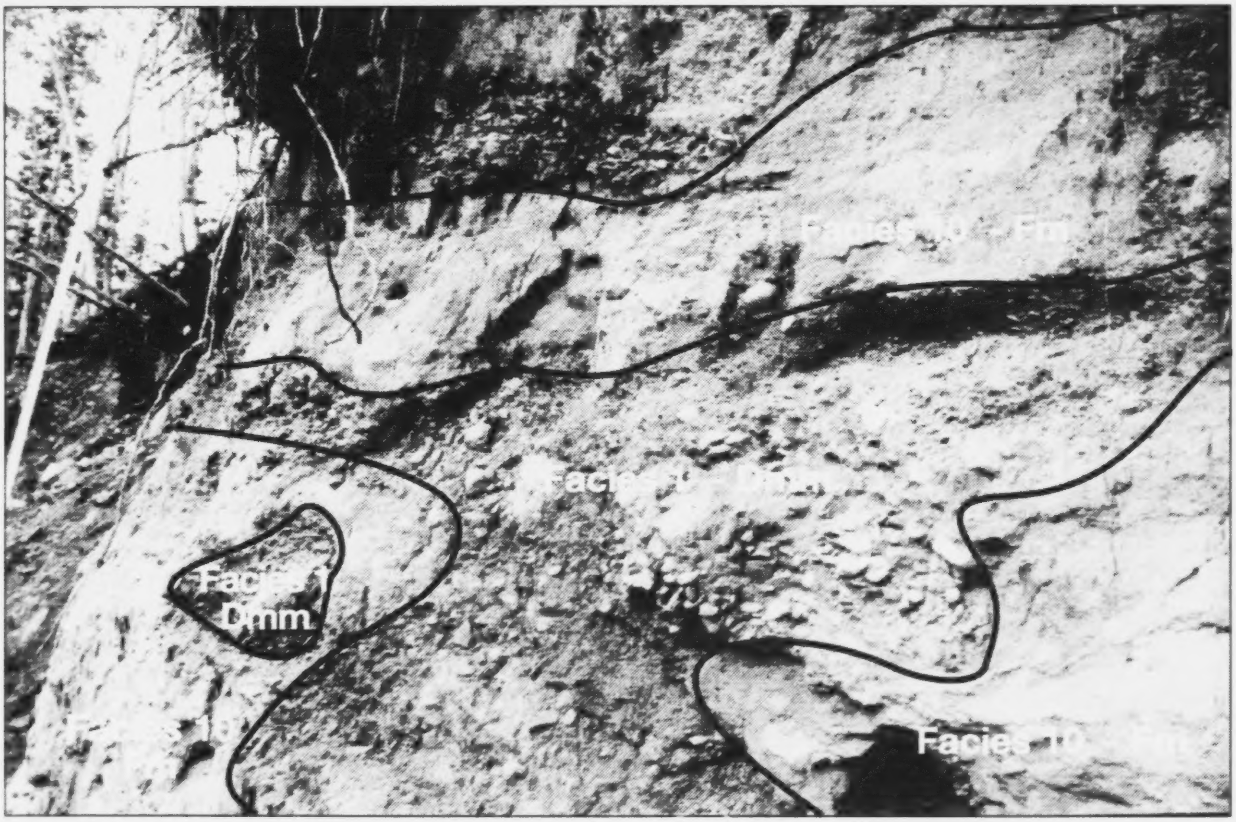


Figure 20. Facies 10 - Fm, massive very fine sand/silt, has moderate to excellent sorting, and individual beds may be difficult to discern. Accessories include woody debris and organic sediments as well as localized ice-wedge casts. Locally, this facies grades vertically and laterally into Facies 1 (Dmm), massive diamict or Facies 2 (Dms), weakly stratified boulder-cobble diamict. Local facies associations also include Facies 11 (Flr), laminated and rippled fine sediment, and Facies 12 (Fo), massive organic-rich silt. This photo shows measured section HCR9701 on the Highet Creek road, where Facies 10 is interpreted to be a fine-grained mass flow deposit originally derived from windblown silt (loess).

units, which are often capped by thin clay layers. In some cases, the laminations show variable grading, including normal (fining-upwards), inverse (coarsening-upwards), and inverse-to-normal. Within the graded-laminites are rare intrabeds of massive sand, pebble-cobble diamict, and dropstones. Cryogenic features such as ice-cast sand wedges commonly occur in the lower 3-4 m of the units belonging to this facies. The laminated/rippled and graded-laminated fine sediment of this facies is associated with Facies 10 massive very fine sand/silt. Graded-laminites ('rhythmites') tend to be preserved in thicker units, up to 6.75 m; whereas the laminated fines with rare discontinuous interbeds of pebble-granule/cobbles are at most 3.75 m thick. Stacked units of graded-laminites ('rhythmites') are up to 20 m thick in the measured sections. Accessories such as woody material are generally absent in those units with graded-laminations and dropstone structures. Organics and woody debris are more common in the laminated and rippled very fine sand and silt. The exception is in the sections at Duncan and Upper Duncan creeks that yielded woody detritus in the graded-laminites with dropstone structures. Colours of units from this facies vary from medium to dark grey, or light olive grey, dusky yellow, and yellowish grey, depending upon the composition of clasts and matrix, and the percentage of admixed organics.

As with Facies 10, this unit was not studied in detail, and only sampled for heavy minerals in one or two cases. Despite the low representation of this facies, there is a low heavy mineral yield, with garnet, ilmenite, along with traces of magnetite and cassiterite. The pay zone at Davidson Creek is from this facies. This facies is rare or less common and was noted in those areas with better preserved finer grained interglacial lacustrine, or proglacial glaciolacustrine sections. These include middle stratigraphic units at Duncan Creek, Thunder Gulch, Ledge Creek, Highet Creek, and Lower Highet Creek (Fig. 21); and, topmost stratigraphic units at Duncan Creek, Goodman Creek and Rodin Creek.

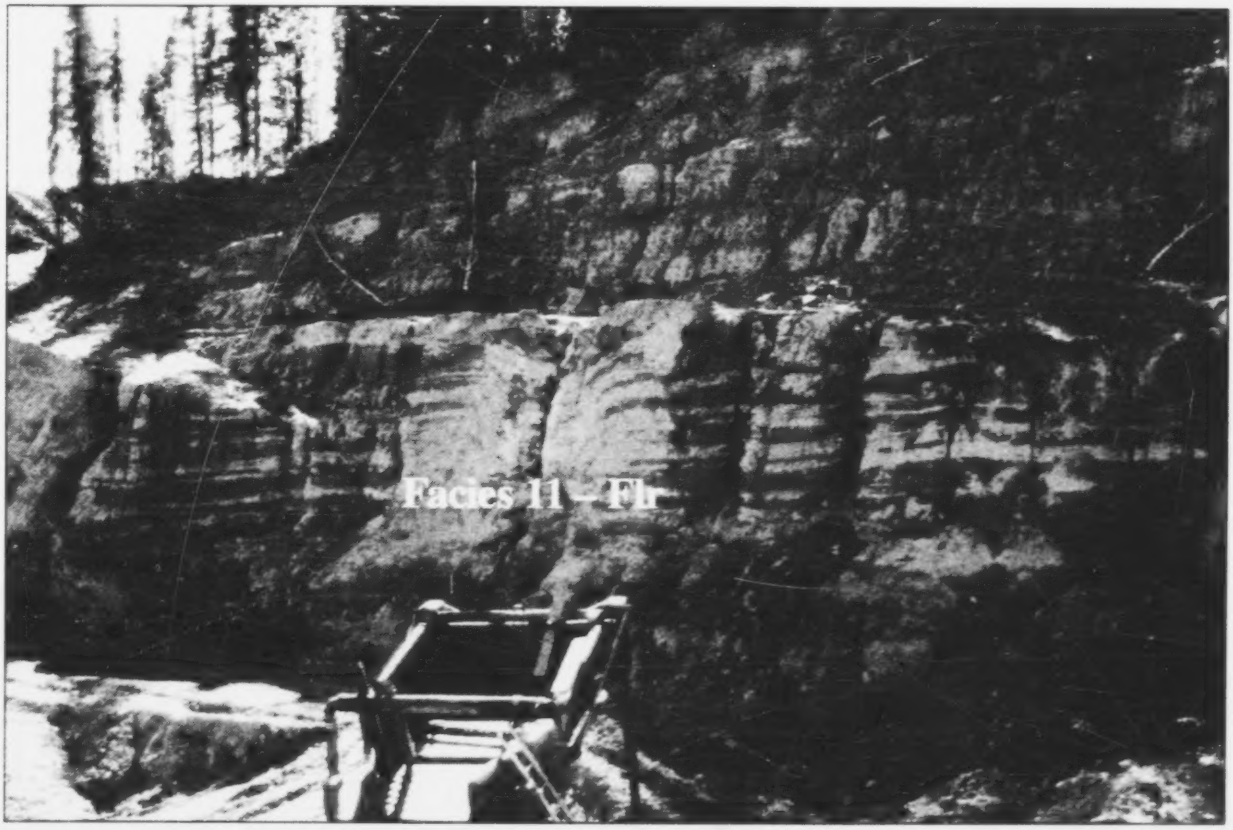


Figure 21. *Facies 11 - Flr, laminated and rippled sand, silt, and mud, consists of stacked units of sand, silt and mud that are planar laminated with common to rare rippled interlaminae. This photo shows measured section HT2/3-95 on Highet Creek, which is interpreted to be a Reid glaciolacustrine sequence overlying interglacial alluvium and underlying Reid glacial till.*

Facies 12: Massive to laminated organic-rich silt (Flo)

This facies consists of very fine sandy silt or silt with a very high content of macerated organics and woody organic debris. Units of this facies range from thin partings to more composite units up to 1 m thick. Faint to distinct parallel lamination may be present. This facies is recognized by its high organic content, with colours varying from greyish-orange to brownish-grey or dark grey, depending upon the organic content and the occurrence of any secondary diagenetic Fe- or Mn-staining. Local clasts from boulder to pebble size occur in this facies in addition to accessories such as macro-organics and volcanic ash (e.g., measured section FT98-1-2, Fig. 22). As with the other fine-grained units, this facies was not studied in detail, with samples analysed from Duncan and Highet creeks. In the Duncan Creek samples, heavy mineral yields were low to medium, in one case dominated by ilmenite, less commonly by pyrite, garnet and magnetite. In the other Duncan Creek sample with low heavy mineral yields, there was a trace of magnetite and zircon. The Highet Creek sample had a low heavy mineral yield, dominated by ilmenite. No gold was recovered from samples of this facies.

This facies is rare and was noted in those areas with better-preserved finer grained interglacial sections, commonly underlying Holocene to Recent organic mats, rooted soil horizons, and locally highly organic 'mucks.' These include topmost stratigraphic units at Seattle, Duncan Creek, Upper Duncan, Thunder Gulch, Goodman Creek, Rodin Creek and Seattle Creek. In interglacial and Holocene settings, woody material can be radiocarbon dated.

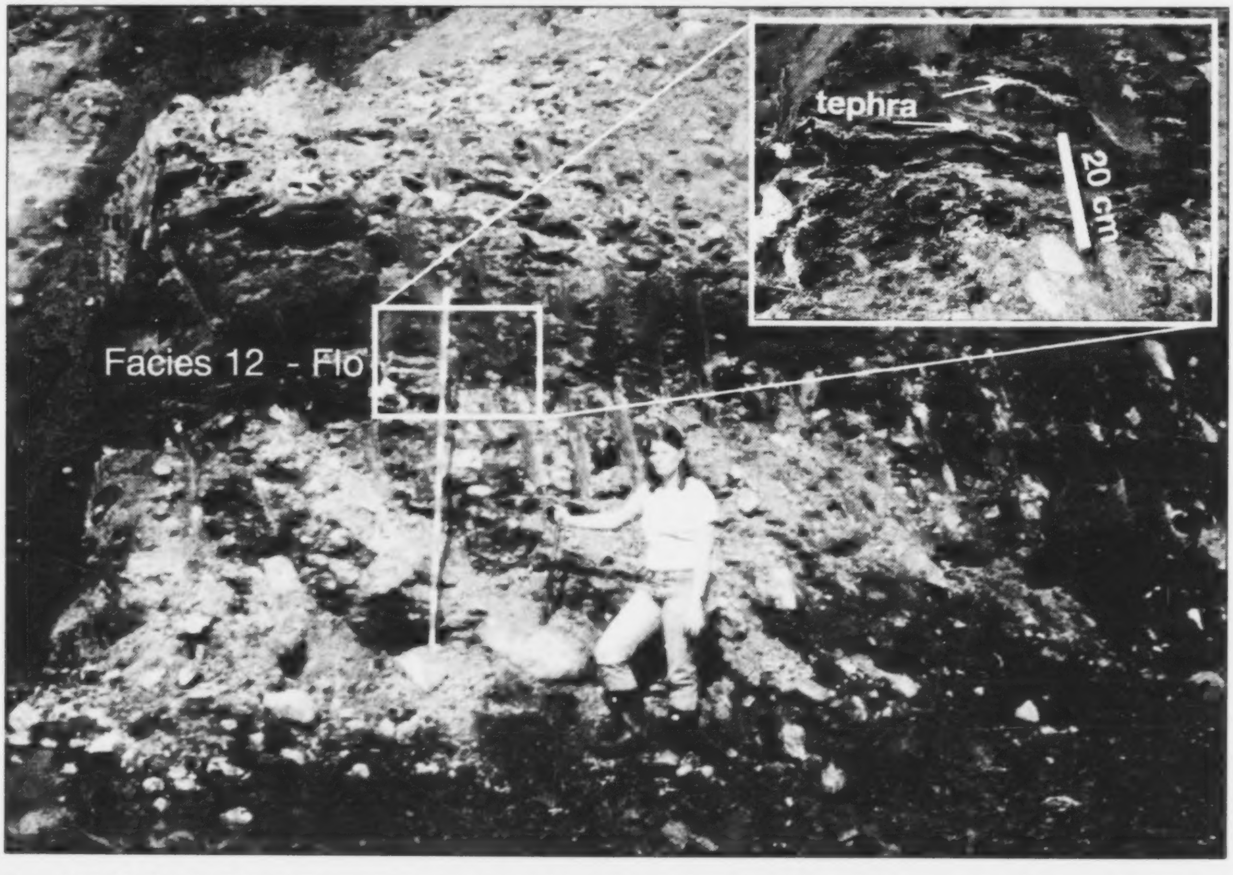


Figure 22. Facies 12 - Flo, massive to laminated organic rich silt, consists of very fine sandy silt or silt with a very high content of macerated organics and woody organic debris. Local clasts from boulder to pebble size occur in addition to accessories such as macro-organics and volcanic ash (e.g., measured section FT98-1-2, pictured here). In interglacial and Holocene settings, woody material can often be radiocarbon dated. A wood sample from this unit was ^{14}C (AMS) dated at >50 030 years B.P.

FACIES INTERPRETATIONS AND LITHOSTRATIGRAPHIC RELATIONSHIPS

The basic interpretation of the origin and processes of deposition of individual facies is given in Table 4. In the following section, these processes are briefly discussed along with a brief outline of the lithostratigraphic relationships that form the basis for the Lithostratigraphic Assemblages discussed in the next section.

Facies 1 (massive boulder-cobble diamict - Dmm) is interpreted to be a lodgement till or a resedimented lodgement till. Facies characteristics such as the very poor sorting, high mud-matrix content, disorganized or chaotic fabrics, and bullet-shaped or flat-iron clast morphologies are typical of glacial till deposits. The compact nature and high matrix content, along with a maximum clast size of 3 m, implies that the deposit is either morainal material or lodgement till. Such deposits are common in ice-contact settings such as u-shaped valleys, proximal glaciofluvial environments, terminal and recessional moraines, and stagnation morainal complexes.

Facies 2 (massive to weakly stratified boulder-cobble diamict - Dms) is interpreted as proximal debris flows, colluvial slope, slump or solifluction deposits. The high percentage of mud-matrix, basal inverse grading, disorganized structures with vertical fabrics, along with the presence of a diffuse horizontal stratification that parallels local slopes, are typical of debris flows or other mass-wasting deposits in proximal high-slope and/or high-discharge areas. Such deposits are common in proximal glacial settings, where glacial tills are reworked by catastrophic meltwater flows; in high discharge proximal glaciofluvial/meltwater channel settings; on high-angle colluviated alluvial slopes; or in steep slope permafrost areas susceptible to solifluction. Local debris flow deposits may form where glacial ice and meltwater discharges into glaciolacustrine margins.

Facies 3 (stratified/imbricated boulder gravel - Gms) is indicative of high traction flows of gravels in a proximal fluvial setting, such as progradation of gravel bars or diffuse gravel sheets. This type of deposit is common in glaciofluvial outwash or meltwater channel settings, although similar facies develop in proximal alluvial canyon-gulch, or alluvial-fan environments under very high discharges or flood conditions. In boulder beds with clasts up to 3 m, the facies is interpreted as subglacial or proximal glaciofluvial outwash, either reworked morainal deposits or subject to extremely high discharge events associated with positions proximal to large glacial ice masses. This facies may occur in glacial or periglacial settings, but is not solely indicative of such environments.

Facies 4 (graded or graded-stratified gravel - Ggh) is interpreted as being deposited very rapidly from basal dispersions associated with high suspended-load flood flows, called 'hyperconcentrated' flood flows. These types of very high discharge, very high suspended load flows are similar to dilute, watery debris flows, and are capable of transporting very high loads of very coarse debris. Such flows may originate as very high seasonal discharge flood events in alluvial environments, or alternatively may record extreme discharges associated with glacial meltwater channel flow. Similar to Facies 3, this type of deposit is indicative of very high discharge-flood events, common in glaciofluvial outwash, glacial meltwater channels, proximal alluvial canyon-gulch, or alluvial-fan environments.

Facies 5 (stratified/cross-stratified gravel - Ghpt) indicates high traction flows that transported gravel as bedload. For horizontally-stratified gravel, transport occurs as traction on bar tops or within channels as tractive carpets, some of which may organize into coarse-grained lobate gravelly bedforms called 'diffuse gravel sheets'. With bed buildup on bar tops or within channels these gravel sheets may develop into gravel bars, with development of foresets, that upon progradation form planar-tabular cross-stratification. Given high or extreme discharge events gravel may be molded into large-scale three-dimensional dune bedforms, that produce trough cross-stratification with downstream migration. Such coarse gravel dunes have been recorded in 'jokulhaup' events associated with failure of ice-dam lakes or with extreme seasonal flood flows in fluvial environments. Similar to the previous gravel facies, these type of deposits record high to very high discharge events, common in glacial meltwater and braided outwash channels, proximal alluvial braided channels, or medial to distal alluvial-fan environments.

Facies 6 massive to stratified pebbly sand (Sh) is a finer grained equivalent to Facies 5 (stratified gravel) deposits. As such the stratified pebbly sand of Facies 6 records either somewhat lower traction flows than that which deposited the coarser gravel of Facies 5, but still under upper flow regime conditions; or, alternatively, a change in sediment supply of coarse gravel debris. Facies 6 units are mostly associated with gravel of Facies 5, and as such, are similarly interpreted as a record of very high discharge events, common in proximal braided outwash or fluvial channels, or medial to distal alluvial-fan environments.

Facies 7, 8 and 9 reflect gradually declining tractive flow events. Facies 7 (planar tabular cross-bedded sand -Sp) units were deposited on braided sand bars under high traction flow events, with downstream progradation producing planar tabular cross-stratification. Facies 8 (trough cross-bedded pebbly sand - St) is a finer grained equivalent of the trough cross-bedded gravel of Facies 5 (Ghpt), whereas Facies 9 (ripple cross-bedded sand – Sr) units are lower flow regime deposits from ripple bedforms. The cross-bedded sand facies are indicative of declining or normal discharge events in braided outwash or fluvial channels, or medial to distal alluvial-fan settings.

Although there is less stratigraphic and sedimentologic control on Facies 10-11, the basic textural properties of these units indicate that they were likely deposited in overbank or alluvial settings distal from coarse-sediment channel environments. Facies 10 (massive very fine sand/silt - Fm) is either a fine-grained mass-flow deposit, or aeolian (windblown) loess. Facies 11 (laminated/rippled sand, silt and mud – Flr) originates as two types, those that are due to suspension waning flood-flows, as in overbank settings; or those that are deposited rhythmically as alternating silt and clay layers in lacustrine or glaciolacustrine settings. Deposits of Facies 12 (massive to diffusely laminated organic silts and muds – Flo) are interpreted to be paleosols that formed in overbank settings or on colluviated and vegetated slopes.

LITHOSTRATIGRAPHIC ASSEMBLAGES

Introduction

Sedimentological and stratigraphic data indicate eight lithostratigraphic assemblages, which are sedimentary facies grouped based on common lithology and stratigraphy. These assemblages occur repeatedly throughout the study area in similar geomorphic landforms and stratigraphic position, and are bounded by unconformable contacts. References to the surficial geology map units, where applicable, are listed in italics.

They are as follows:

1. Pre-Reid interglacial alluvium;
2. Early and Middle Reid glaciofluvial, glacial and periglacial sediments;
3. Late Reid glacial and periglacial sediments;
4. Post-Reid (Koy-Yukon) interglacial alluvium;
5. Early and Middle McConnell periglacial sediments;
6. McConnell glacial, glaciofluvial and glaciolacustrine sediments;
7. Late McConnell periglacial sediments; and
8. Holocene alluvial sediments.

Descriptions of assemblages

Lithostratigraphic Assemblage 1 – Pre-Reid interglacial sediments

Assemblage 1 consists of Pre-Reid interglacial fluvial, gulch and alluvial fan sediments that have been variably reworked and/or buried. It includes Facies 5 (stratified pebble-cobble gravel - Ghpt), Facies 6 (massive to stratified pebbly medium sand - Sh), Facies 7 (planar tabular cross-stratified pebbly medium sand - Sp), Facies 8 (trough-cross-bedded pebbly sand), Facies 9 (ripple-cross-bedded sand - Sr), Facies 11 (laminated/rippled silt and clay - Flr) and Facies 12 (massive to laminated organic silt - Flo). It occurs in the lowest stratigraphic position below Assemblage 2, however it is commonly preserved only in valleys transverse to paleo-ice-flow.

Lithostratigraphic Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments

Assemblage 2, associated with the Reid glacial advance and maximum (Early and Middle), consists mainly of glaciofluvial (G^Rp, G^Rt, G^Rx), glacial (T^Rv, T^Rb, T^Rx) and periglacial sediments (A^Rf, A^Rx) with local variably reworked pre-Reid interglacial fluvial sediments. The dominant facies are Facies 1 (massive boulder-cobble diamict - Dmm), Facies 2 (stratified boulder cobble diamict - Dms), Facies 3 (stratified/imbricated boulder-cobble gravel - Gms), Facies 4 (graded or graded/stratified gravel - Ggh) and Facies 11 (laminated/rippled silt and clay - Flr). This assemblage is usually preserved on slopes and plateaus in areas outside of the McConnell glacial limit.

Lithostratigraphic Assemblage 3 – Late Reid glaciofluvial, glacial and periglacial sediments

Assemblage 3, associated with deglaciation, is dominated by glaciofluvial (G^Rp, G^Rt, G^Rx) and periglacial sediments (A^Rf, A^Rx) with minor amounts of glacial sediments (T^Rv, T^Rb, T^Rx). The dominant facies are Facies 1 (massive boulder-cobble diamict - Dmm), Facies 2 (stratified boulder cobble diamict - Dms), Facies 3 (stratified/imbricated boulder-cobble gravel - Gms), and Facies 4 (graded or graded/stratified gravel - Ggh). This assemblage occurs mainly in a low stratigraphic position near bedrock, or lying unconformably in contact with Assemblage 2.

Lithostratigraphic Assemblage 4 - Post-Reid (Koy-Yukon) interglacial alluvium

Assemblage 4 consists mainly of fluvial, gulch and alluvial fan sediments that have been variably reworked and/or buried. It includes Facies 5 (stratified pebble-cobble gravel - Ghpt), Facies 6 (massive to stratified pebbly medium sand - Sh), Facies 7 (planar tabular cross-stratified pebbly medium sand - Sp), Facies 8 (trough-cross-bedded pebbly sand), Facies 9 (ripple-cross-bedded sand - Sr), Facies 11 (laminated/rippled silt and clay - Flr) and Facies 12 (massive to laminated organic silt - Flo). It mainly occurs in the middle stratigraphic position above Assemblages 2 and 3, however it is rarely preserved.

Lithostratigraphic Assemblage 5 – Early and Middle McConnell periglacial sediments

Assemblage 5, associated with the McConnell glacial advance and maximum, consists mainly of sediments deposited under periglacial climatic conditions ($A^{M}f$, $A^{PM}p$, $A^{PM}t$, $A^{PM}f$), either outside of the McConnell glacial limit or within the limit but immediately prior to the arrival of the McConnell ice sheet. It includes Facies 1 (massive boulder-cobble diamict - Dmm), Facies 2 (stratified boulder-cobble diamict - Dms), Facies 6 (massive to stratified pebbly sand), Facies 7 (planar tabular cross-bedded sand) and Facies 10 (massive very fine sand/silt - Fm). It occurs either on bedrock or stratigraphically higher than Assemblage 4 along an unconformable contact; elements of both Assemblages 3 and 4 are mostly present including resedimented till and reworked organic material. Within the McConnell glacial limit, it lies disconformably beneath sediments of Assemblage 6.

Lithostratigraphic Assemblage 6 - Middle McConnell glacial, glaciofluvial and glaciolacustrine sediments

Assemblage 6, associated with McConnell glacial maximum, consists of well-preserved glaciofluvial ($G^{M}p$, $G^{M}t$), glacial ($T^{M}v$, $T^{M}b$, $T^{M}x$)and glaciolacustrine sediments ($L^{M}b$) of McConnell age. It includes intercalated Facies 1 (massive boulder-cobble diamict - Dmm), Facies 2 (stratified boulder-cobble diamict – Dms), Facies 3 (stratified/imbricated boulder-cobble gravel – Gms), Facies 4 (graded or graded/stratified gravel – Ggh), Facies 10 (massive very fine sand/silt - Fm) and Facies 11 (laminated/rippled sand, silt and clay - Flr). This package commonly rests disconformably over Assemblages 5, 4 and 3, generally at a high stratigraphic position on slopes, terraces and plateaus within the McConnell glacial limit. In valley settings, it is crosscut by sediments of Assemblage 8.

Lithostratigraphic Assemblage 7 – Late McConnell periglacial sediments

Assemblage 7, associated with McConnell deglaciation, consists of sediments deposited under periglacial climatic conditions ($A^{M}f$), either outside of McConnell glacial limit or within the limit, but immediately after the retreat of the McConnell ice sheet. It includes Facies 1 (massive boulder-cobble diamict - Dmm), Facies 2 (stratified boulder-cobble diamict - Dms), Facies 6 (massive to stratified pebbly sand), Facies 7 (planar tabular cross-bedded sand) and Facies 10 (massive very fine sand/silt - Fm). Outside of the McConnell glacial limit, this assemblage occurs either on bedrock or stratigraphically higher than Assemblages 2-5 along an unconformable contact; elements of these assemblages are usually present including resedimented till and reworked organic material. Within the McConnell glacial limit, this assemblage includes reworked elements of Assemblage 6, which were deposited during ice retreat.

Lithostratigraphic Assemblage 8 - Holocene alluvial, colluvial and eolian sediments

Assemblage 8 resembles Assemblage 4 however the sediments have been subjected to little burial or reworking (*Ap, At, Af, Ax, Cv, Ca, Ev*). It is dominated by fluvial, gulch and fan sediments including Facies 5 (stratified pebble-cobble gravel - Ghpt), Facies 6 (massive to stratified pebbly medium sand – Sh), Facies 7 (planar tabular cross-stratified pebbly medium sand - Sp), Facies 8 (trough cross-bedded pebbly sand), Facies 9 (ripple cross-bedded sand – Sr), Facies 11 (laminated/rippled silt and clay - Flr) and Facies 12 (massive to laminated organic silt – Flo). Scattered occurrences of Facies 4 (graded or graded/stratified gravel – Ggh) have been noted. As Facies 4 crosscuts and erodes previously existing sediments, it commonly contains elements of all other assemblages including reworked till, glacial boulders and organic material. It may be the only assemblage present especially in tributary gulches where it lies unconformably on bedrock.

PLACER MINING AREAS – DETAILED STUDIES

DUNCAN CREEK/KENO HILL

Introduction

Duncan Creek, a tributary of the Mayo River, was first prospected at the turn of the century and is historically one of the most actively mined drainages in the Mayo District. Since 1995, however, only two mining operations have been active, the Taylor family (Duncan Creek GoldDusters) on Duncan Creek (Fig. 23) and the Barchen family (Bardusan Placers) on Lightning Creek, Thunder Gulch and Upper Duncan Creek (Fig. 24). Gold production from Duncan Creek and its tributaries in the last 15 years is nearly 34,000 crude ounces (1 057 519 g), with historical production estimated to be at least twice that for the last 95 years.

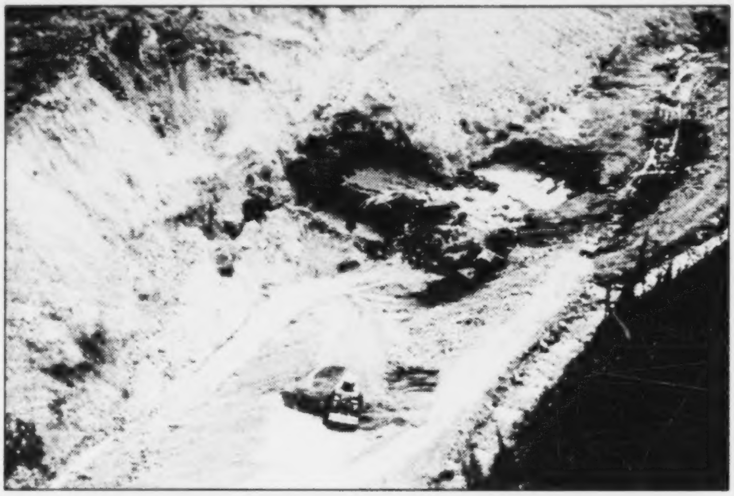


Figure 24. *Aerial view of Bardusan Placers mining operation on Upper Duncan Creek in 1996. Wood found in two layers in measured section UD9602 was radiocarbon dated at 33 190 ± 880 years B.P. and 31 580 ± 620 years B.P.*

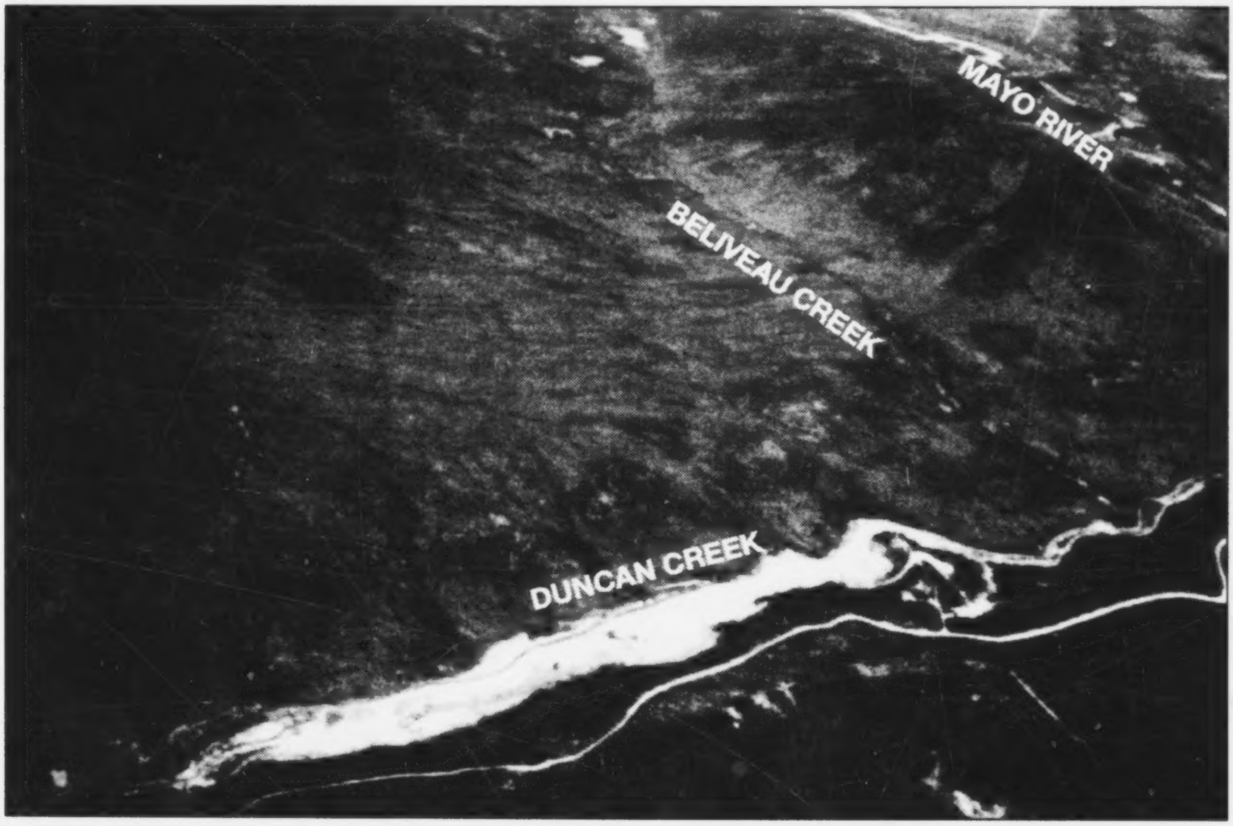


Figure 23. *Aerial view of Duncan Creek GoldDusters placer mining operation in 1996. The McConnell glacial ice advanced north from Mayo River valley up Duncan Creek valley, reaching approximately the lower left extent of this photo.*

Location and access

The Duncan Creek/Keno Hill area is located on NTS map areas 105M/13 and 105 M/14, between latitude 63° 45'N and 64°00'N and longitude 135°00'W to 136°00'W (Fig. 25). Access from the town of Mayo is via hard-surfaced road (the Silver Trail) and gravel road (Duncan Creek road), a distance of approximately 40 km. Duncan Creek road joins with the Silver Trail on both ends, forming a loop with the village of Keno City on the north intersection.

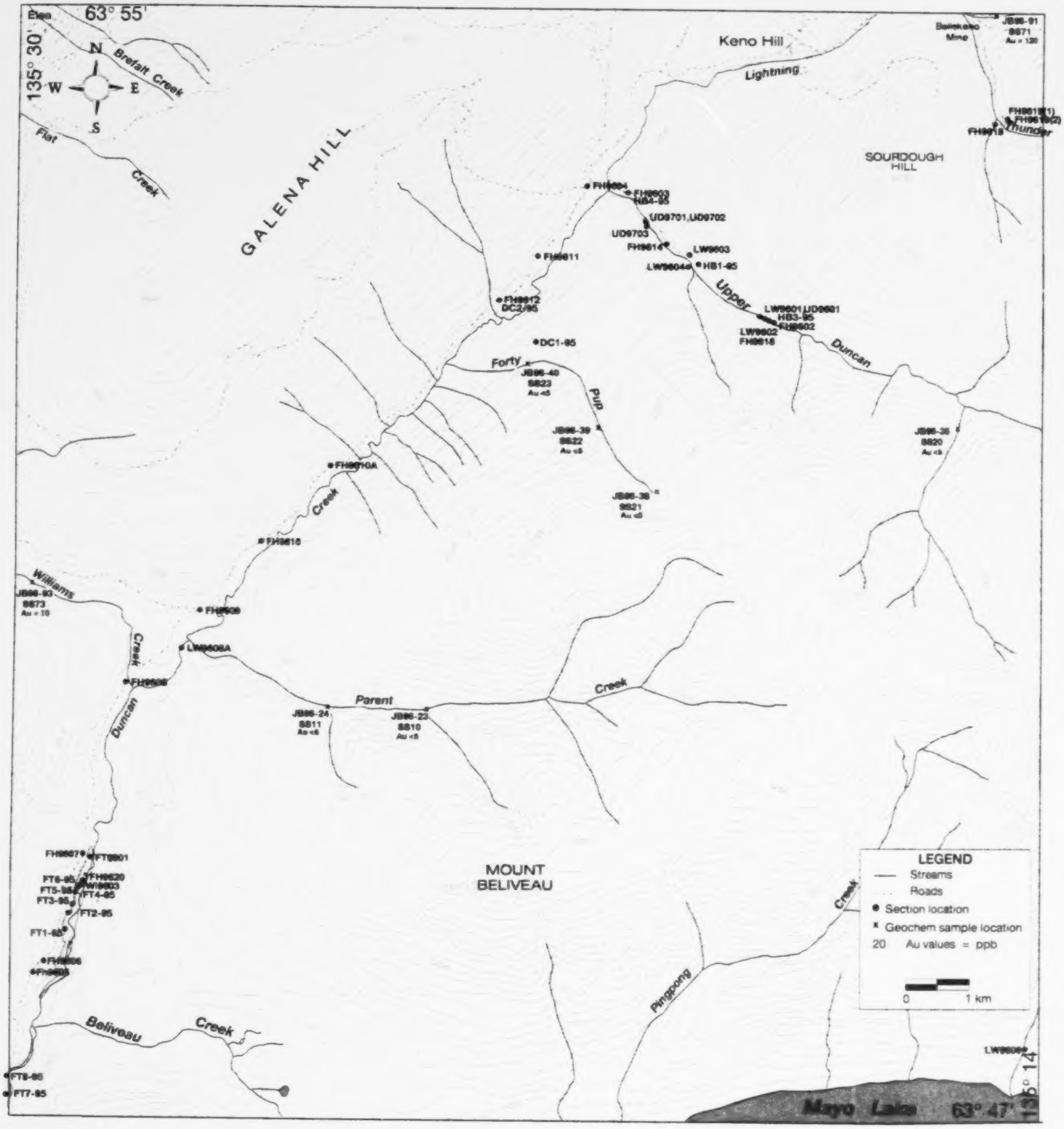


Figure 25. Measured section and geochemical sample locations, Duncan Creek area.

Physiography

The Stewart plateau is characterized by wide, flat-bottomed valleys, which separate blocks of broad, smooth uplands (Bostock, 1948). Near the centre of the field area is the Gustavus Range, which is bounded by wide valleys containing the Keno-Ladue River to the north, the South McQuesten River to the west, and Mayo Lake to the south (Fig. 2). The elevation of the valleys averages 2200 ft (670 m) while several peaks including Mt. Hinton, at the core of the Gustavus Range, lie above 6500 ft (2000 m). The uplands contain several cirques, which form the headwaters of many of the local streams including Duncan and Lightning creeks in the north, and Granite and Keystone creeks to the south.

Local geology

The Robert Service Thrust Fault traverses the field area, thrusting Upper Proterozoic to Lower Cambrian Hyland Group phyllite, psammite and marble over Mississippian Keno Hill Quartzite and Devono-Mississippian Earn Group graphitic schist, phyllite and sericite schist (Murphy, 1997). Triassic metadiorite sills intrude the Paleozoic sequence (Murphy, 1997).

Hosted within the Keno Hill Quartzite are over sixty silver-lead and gold vein deposits, nearly all of which have been mined for silver (Yukon MINFILE, 1997).

Surficial geology

Unconsolidated sediments in the Gustavus Range and the surrounding plateaus consist mainly of deposits from Cordilleran valley glaciers (continental ice sheet), alpine glaciers (local montane glaciers), colluvium, and minor alluvium (Bond 1998d, in pocket). Most of the upland areas are covered with a veneer of colluviated bedrock and scattered solifluction deposits. Exposed bedrock is common in the headwalls of cirques, along ridge-tops, and where frost weathering has carved out nivation hollows on north-facing slopes. Most glacial deposits in the area are McConnell age alpine and Cordilleran deposits. Deposits from the Reid and pre-Reid glaciations were noted above the McConnell limit on the uplands flanking the Gustavus Range, particularly near Duncan, Williams, and Field creeks (Bond 1998d). A natural section on lower Duncan Creek has exposed Reid or older till under McConnell sediments (Fig. 26), which suggests that large trunk valleys may also contain stacked deposits of older glacial sediments (Fig. 27). A Reid till blanket was identified in Parent Creek, and in Upper Duncan Creek a Reid till blanket and resedimented till overlie gold placers. Reid till and outwash were also mapped at the summit of Galena Hill and at a divide between Thunder Gulch and upper Duncan Creek. Overall, slope processes have eroded much of the evidence of older glaciations at the higher elevations.

McConnell Cordilleran deposits line the valleys of the Keno-Ladue River, South McQuesten River, Mayo River, and Duncan Creek and include sequences of meltout till, basal till, outwash plains, and outwash channel deposits. McConnell alpine glacial deposits are found in Faro Gulch, McNeill Gulch, McMillan Gulch, Allen Creek, Granite

__Figure 26.__ Measured section FT95-08, a natural exposure at the mouth of Duncan Creek near its confluence with Mayo River. This sequence of weathered pre-McConnell (possibly Reid) till beneath two distinct McConnell tills suggests that large trunk valleys throughout the Mayo area may contain stacked deposits of older glacial sediments in addition to the surface McConnell deposits.

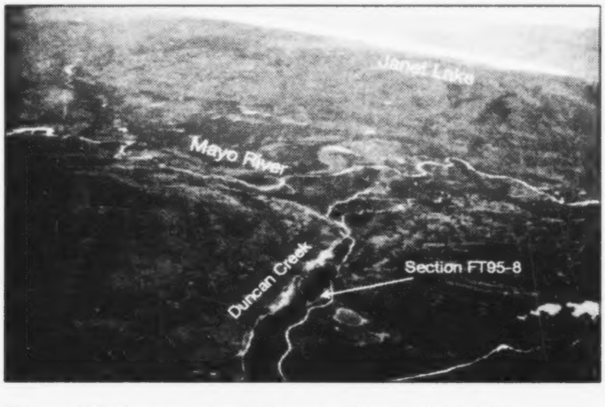


__Figure 27.__ Duncan Creek flows south into Mayo River which drains Mayo Lake in a large glacially-scoured valley. Multiple tills are exposed in a natural exposure (measured section FT95-8) on Duncan Creek.

Creek, upper Duncan Creek, and in three other unnamed valleys in the Gustavus Range (Bond 1998d, in pocket). The glacial deposits remain intact in the valley bottoms, however they are commonly draped with a colluvial apron. Large terminal moraines were deposited at the mouth of McNeill and McMillan Gulches, which nearly join with a Cordilleran moraine in Faith Creek. Outwash terraces on the north side of Lightning Creek were deposited by meltwater exiting to the west into the Duncan Creek drainage. In Granite Creek valley, thick deposits of Cordilleran till blanket the lower part of the drainage and nearly merge with local alpine moraines originating from Mount Hinton.

Sedimentology

Introduction

Fifty-three sections were examined in detail in the Duncan Creek area between 1995 and 1998. Sections were located at active mining cuts and stream cutbanks on Duncan, Upper Duncan and Lightning Creeks, Thunder Gulch, and other Duncan Creek tributaries. Figure 24 shows the location of the sections; this information is also summarized in Appendix 1a.

Dominant facies and interpreted environments of deposition

Duncan Creek lies at the margin of the McConnell glaciation; some portions of the creek and tributaries lie within the ice limit and some lie outside of the glacial limit. In addition, the drainage is completely within the Reid glacial limit, which deposited thick sequences of till and outwash in the Duncan Creek valley. Consequently, glacial, glaciofluvial and glaciolacustrine sediments are dominant, which includes Facies 1 to 3 and Facies 11. Facies 1 (massive boulder-cobble diamict – Dmm) occurs mainly in contact with bedrock on Duncan Creek, Upper Duncan Creek and Thunder Gulch. It is interpreted as a Reid age glacial till. Facies 2 (weakly stratified boulder-cobble-pebble diamict -Dms) is found throughout the area either on bedrock or higher in the section, commonly in association with Facies 1. This unit is interpreted as deposited by proximal debris flows associated with the reworking of glacial deposits (Facies 1), typical in ice marginal settings. Facies 3 (weakly stratified/imbricated boulder gravel - Gms) is the main pay unit on Duncan Creek where it is associated with Facies 1 and 2. It is interpreted as Reid age proximal glaciofluvial outwash. Thick sequences of Facies 11 (laminated and rippled sand, silt and mud - Flr) are preserved in the main valley of Duncan Creek where they overlie Facies 1 to 3. This sediment was deposited as a proglacial lake during the McConnell glacial episode.

Stratigraphy

Representative stratigraphic sections

Figure 28 is a panel diagram showing typical stratigraphy in the main valley of Duncan Creek (measured section FT98-1-1). Additional stratigraphic sections are located in Appendix 4.

Lithostratigraphic assemblages

Seven lithostratigraphic assemblages are found in the Duncan Creek area; a representation of these is shown in Figure 29, which is a schematic cross-valley profile of Duncan Creek.

They are as follows:

- Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments;
- Assemblage 3 – Late Reid glacial and periglacial sediments;
- Assemblage 4 – Post-Reid (Koy-Yukon) interglacial alluvium;
- Assemblage 5 – Early and Middle McConnell periglacial sediments;
- Assemblage 6 – McConnell glacial and glaciofluvial sediments;
- Assemblage 7 – Late McConnell periglacial sediments; and
- Assemblage 8 – Holocene alluvial sediments.

Stratigraphic relationships

Lithostratigraphic Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments

In Duncan Creek, this assemblage is most commonly preserved on slopes and plateaus in areas outside of the McConnell glacial limit, for example, the Reid outwash on the divide between Williams Creek and Field Creek.

Lithostratigraphic Assemblage 3 – Late Reid glaciofluvial, glacial and periglacial sediments

Along the main valleys of Duncan and Upper Duncan creeks this assemblage occurs in the lowest stratigraphic position on bedrock, lying unconformably in contact with Assemblage 2.

Lithostratigraphic Assemblage 4 – Post-Reid (Koy-Yukon) interglacial alluvium

This assemblage is relatively well preserved in Upper Duncan Creek, where it forms alluvial fans overlying periglacial or glacial sediments of Reid age (Assemblages 2 and 3, radiocarbon dates in Table 5). In the main valley of Duncan Creek, this assemblage is locally preserved between Reid outwash and McConnell lacustrine sediments and till.

Lithostratigraphic Assemblage 5 – Early and Middle McConnell periglacial sediments

Assemblage 5 occurs either on bedrock or stratigraphically higher than Assemblage 4 along an unconformable contact; elements of Assemblages 2, 3 and 4 are commonly present including resedimented till and reworked organic material. Within the McConnell glacial limit, it lies disconformably beneath sediments of Assemblage 6, as it was deposited prior to ice advance. This assemblage was noted in several locations in mining exposures on Duncan Creek, and is especially well exposed in Section FT98-1.

Lithostratigraphic Assemblage 6 – McConnell glacial and glaciofluvial sediments

Assemblage 6 lies disconformably over Assemblages 5, 4 and 3, generally at a high stratigraphic position on slopes, terraces and plateaus within the McConnell glacial limit. In Duncan Creek valley, it is reworked and cut by sediments of Assemblage 8.

Lithostratigraphic Assemblage 7 – Late McConnell periglacial sediments

McConnell periglacial alluvial fan sediments were noted outside of McConnell ice limit along Duncan Creek; these fans were probably deposited continuously throughout the McConnell glaciation, depositing sediments of Assemblage 7 on top of Assemblage 5.

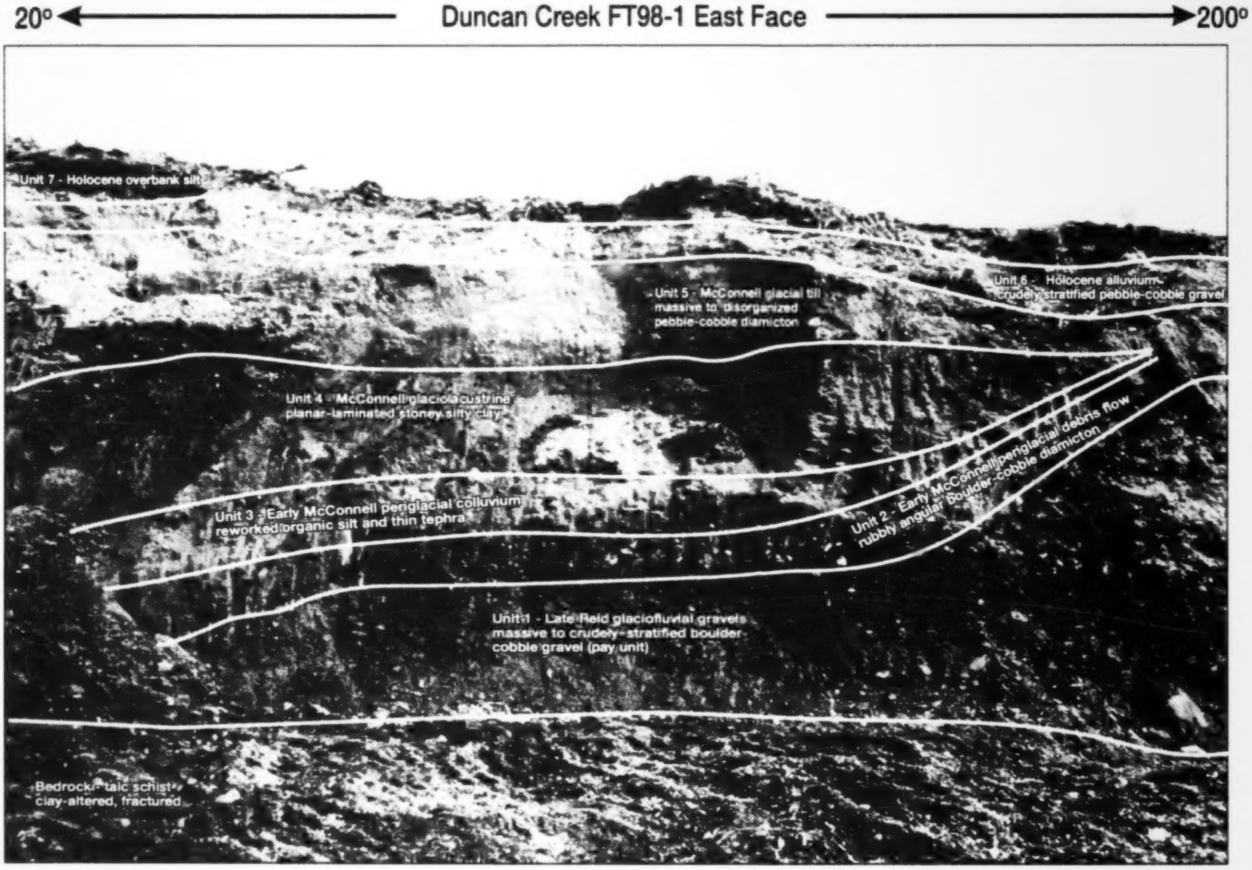

20° ← Duncan Creek FT98-1 East Face → 200°
Unit 7 - Holocene overbank silt
Unit 5 - McConnell glacial till massive to disorganized pebble-cobble diamicton
Unit 6 - Holocene alluvium crudely stratified pebble-cobble gravel
Unit 4 - McConnell glaciolacustrine planar-laminated stoney silty clay
Unit 3 - Early McConnell periglacial colluvium reworked organic silt and thin tephra
Unit 2 - Early McConnell periglacial debris flow rubbly angular boulder-cobble diamicton
Unit 1 - Late Reid glaciofluvial gravels massive to crudely-stratified boulder-cobble gravel (pay unit)
Bedrock - talc schist clay-altered, fractured

Figure 28. *Panel diagram showing typical stratigraphy on Duncan Creek. Reid glaciofluvial outwash is unconformably overlain by periglacial and glacial sediments of McConnell age.*

Lithostratigraphic Assemblage 8 – Holocene alluvial, colluvial and eolian sediments

Along the left limit on the lower reaches of Duncan Creek, Holocene alluvial gravels (Table 6) are in contact with the bedrock rim on the valley side. On the valley centre and right limit, Holocene alluvial gravels lie in contact with McConnell glaciolacustrine silt and glacial till.

Paleogeographic history

Evidence of the pre-Reid glaciations in Duncan Creek area is limited to erratics that are found at elevations of up to 5400 ft (1600 m) and a remnant cirque on Thunder Gulch. Paleoflow of Cordilleran ice likely initially followed topography before merging with alpine glaciers and overtopping the hills.

***Table 5.** Radiocarbon dates for Koy-Yukon Interglacial, Duncan Creek*

Unit number	Sample number	Location	^{14}C Date (type)	Comments
FH9602	Beta-102614	Upper Duncan	>41 000 (conventional)	midway fines
UD9602-1	Beta-102620	Upper Duncan	33 190 ± 880 (conventional)	lower organics
UD9602-2	Beta-102621	Upper Duncan	31 580 ± 620 (conventional)	upper organics
UD97-02-04	Beta-109148	Upper Duncan	27 400 ± 220 (conventional)	organic silt
FT2-95-09	Beta-86851	Duncan Creek	32 320 ± 1270 (conventional)	wood
FH96012-1	Beta-102613	Duncan Creek	36 080 ± 1600 (conventional)	unit 1
FH9620	Beta-102617	Duncan Creek	>47 870 (Conventional)	Taylors W side organics
FH96012-8	Beta-111598	Duncan Creek	30 800 ± 500(ams)	unit 8
FT97-01-02	Beta-111600	Duncan Creek	>46 610 (conventional)	Taylors fall '97 cut
FT98-1-02	Beta-127492	Duncan Creek	>50 030 (ams)	organic with tephra

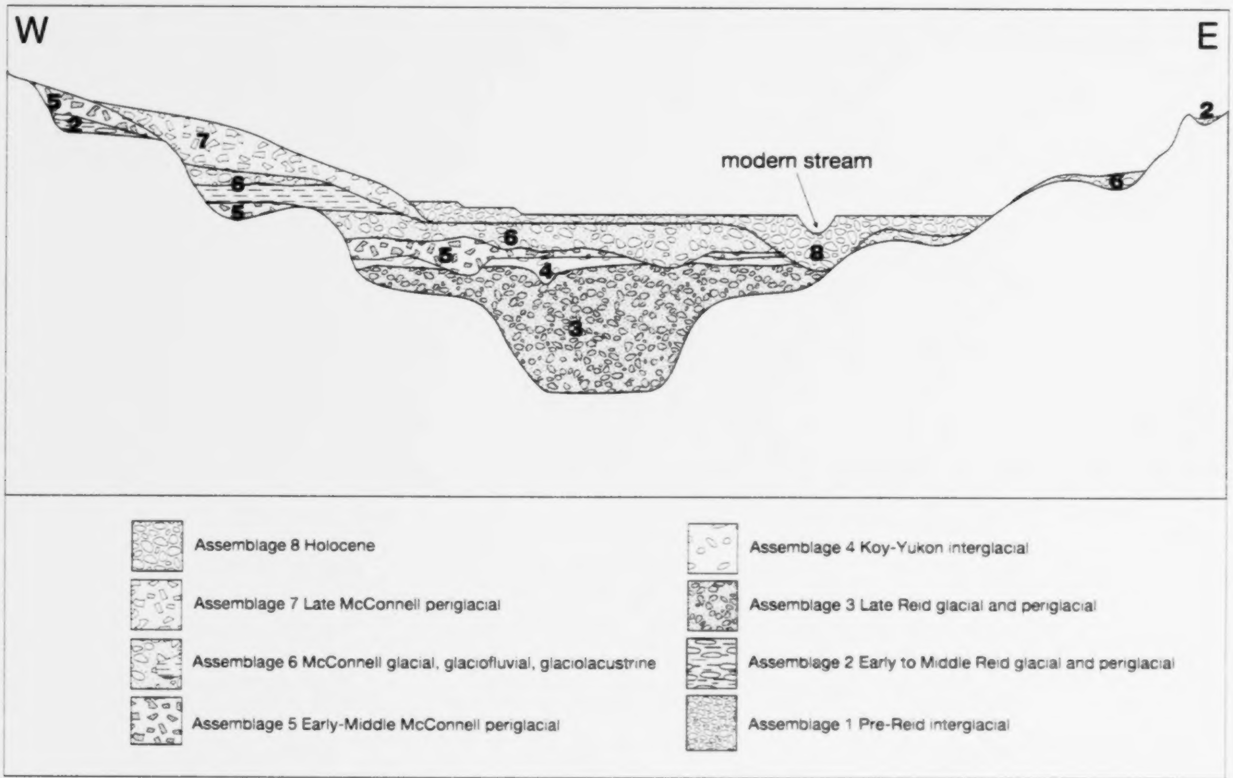

W
E
5
2
7
6
5
modern stream
2
6
6
5
4
8
3
Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial and periglacial
Assemblage 1 Pre-Reid interglacial

***Figure 29.** Schematic cross-valley profile of Duncan Creek, showing relations between lithostratigraphic assemblages. Not to scale.*

Table 6. *Radiocarbon dates for Holocene sediments, Duncan Creek.*

Unit number	Sample number	Location	¹⁴C Date (type)	Comments
FH9602-6	Beta-102615	Upper Duncan	5420 ± 70 (conventional)	Unit 6 wood
FH9601-3	Beta-111599	Upper Duncan	5110 ± 40 (conventional)	Unit 3 organics

During the Reid glaciation, ice filled most valleys to elevations of at least 1280 m, spilling outwash gravel over ridges including the divide between Williams and Field creeks, and the divide between Upper Duncan Creek and Thunder Gulch. Duncan Creek hosted a large glacial ice sheet, which deposited morainal drift and glaciofluvial outwash gravel. During the following interglacial (Koy-Yukon), fluvial systems stabilized and placer deposits formed while slope processes eroded much of the evidence of the older glaciations in the higher elevations.

Climatic cooling brought the McConnell glaciation to the area, although it was not as extensive as previous glaciations. Glacial ice advanced only a few kilometres up Duncan Creek valley from the south. McConnell glacial ice also blocked the northern extent of Duncan Creek valley, advancing to near its confluence with Lightning Creek. An extensive pro-glacial lake formed as a result of the ice blocking the drainage of the valley. Glaciolacustrine and glaciofluvial sediments inundated the valley to depths of up to 40 or more metres. In many areas along the McConnell ice margin these sediments buried pre-existing interglacial placers. Cordilleran ice also advanced into the valleys of Crystal, Faith, McKim, and Granite creeks. Near Keno City, Cordilleran outwash breached the divide into Duncan Creek and truncated a periglacial fan emanating from Upper Duncan Creek. McConnell alpine glaciers formed in Faro Gulch, McNeill Gulch, McMillan Gulch, Allen Creek, Granite Creek, upper Duncan Creek, and in three other unnamed valleys in the Gustavus Range (Bond 1998d).

Ice advancing from the mouth of McNeill and McMillan Gulches nearly coalesced with a Cordilleran ice lobe in Faith Creek. Most of the meltwater exited to the west into the Duncan Creek drainage. In Granite Creek valley Cordilleran ice nearly merged with alpine ice originating from Mount Hinton. The timing of the Cordilleran ice entering the range and alpine glaciers reaching their maximum may not have coincided. Because alpine glaciers had a local source they responded to climatic changes faster than the Cordilleran glaciers, which had distant accumulation zones in the Ogilvie and Selwyn Mountains. Lateral moraines from an unnamed alpine glacier originating from Mount Albert appear to be crosscut by lateral moraines from the Cordilleran glacier that advanced up Granite Creek. This supports the inferred timing for this area that alpine glaciers often reached their maximum limit prior to the Cordilleran ice sheet entering the region. The moraines also indicate a re-advance by both glaciers following retreat from the glacial maximum.

In the Keno-Ladue and South McQuesten river valley, glacial deposits were subjected to little post-glacial fluvial erosion. In contrast, the Mayo River valley glacial deposits were intensely eroded by outwash from the Mayo Lake valley glacier as it retreated. This base level change triggered downcutting that reached into Duncan Creek valley, partially re-excavating the valley fill. Post-glacial erosion by Lightning and Duncan Creek left the outwash surface as a high bench in the valley.

Placer geomorphology

The most significant gold-bearing gravel in the Duncan Creek area is the Reid outwash gravel (Lithostratigraphic Assemblage 3), which, in the lower reaches, lines most of the valley floor on bedrock. This outwash gravel likely incorporated a pre-existing (pre-Reid interglacial) placer deposit, which resulted in the dispersion of high-grade interglacial pay gravel into large volumes of glaciofluvial sediment. During the late stage of the Reid glaciation, meltwater erosion was sufficient to rework some of the dispersed gold into higher-grade concentrations near bedrock. This gravel may represent the largest potential buried placer gold deposit in the Mayo District.

After the Reid glaciation, high-discharge, sediment-laden glaciofluvial systems changed to non-glacial fluvial systems with lower, more constant flow rates and less sediment. Significant reworking of valley alluvium allowed the formation of high-grade placer deposits in the interglacial period.

During the McConnell glaciation, ice advanced into Duncan Creek from both ends, effectively burying pre-existing interglacial placers under 40 or more metres of glaciolacustrine and glaciofluvial sediments.

Post-McConnell downcutting significantly changed the morphology of the Duncan Creek drainage. Downcutting by the Mayo River, following the last glaciation, triggered a base level change in Duncan Creek and increased erosion throughout the main valley of the drainage. Duncan Creek eroded through McConnell glacial sediments in the lower part of the drainage and continued into the placer gold-bearing Reid outwash gravel. The influence of the base level change continued upstream as far as Lightning Creek and McNeill Creek. Upper Duncan Creek was not downcut as quickly as Duncan Creek and consequently was left as a hanging valley. Upper Duncan Creek has since eroded a canyon at the junction of the two valleys, which is where placer gold was first discovered in the Mayo district in 1898. This deposit consisted of sediment reconcentrated from a higher surface that represented the former mouth of Upper Duncan Creek. In Duncan Creek valley, post-glacial fluvial reworking of gold-bearing alluvium and bedrock sources created modern gulch and valley-floor placers on top of McConnell glacial drift and schist bedrock.

The development of local glaciers may have played a significant role in liberating lode gold into the placer environment. Glacial movement at the head wall of the cirque erodes bedrock into the glacial system, which eventually works its way into the fluvial environment following the glaciation. A lengthy post-glacial fluvial reworking period is then critical for placer development. It appears that the north-facing glacial valleys in the Gustavus Range, despite having considerable glacial activity, have not been exposed to sufficient post-glacial reworking to form placers. All north-trending valleys have actually produced fewer placers than valleys that were last glaciated during the pre-Reid and/or Reid glaciations. Viable placers may be found in sections of the recently glaciated valleys, but would largely consist of immature deposits. West-facing valleys like Upper Duncan Creek and Thunder Gulch have experienced long periods of hydrological reworking and subsequently have produced more abundant and coarser gold placers. Some of the placer deposits in Upper Duncan Creek may have actually been reworked to the mouth of the valley during the McConnell glaciation by meltwater from small alpine glaciers. This is discussed further in the section on "Regional Investigations."

MAYO LAKE/DAVIDSON CREEK

Introduction

Many of the streams in the Mayo Lake area including Ledge, Davidson, Cascade, Anderson and Steep creeks have seen historical placer prospecting and mining activity since 1903. In recent years, modern mechanized placer mining has taken place on Davidson, Steep, Ledge, Anderson and Dirksen creeks. Recorded placer gold production for Mayo Lake tributaries from 1903 to 2000 totals 8432 crude ounces (263 819 g), however as this figure is derived only from incomplete placer royalty records, the total gold production is likely much higher.

Location and access

Mayo Lake lies on NTS map sheets 105M/10, 105M/11, 105M/14 and 105M/15. Access from Mayo is via the Silver Trail highway and the Duncan Creek road, a distance of approximately 45 km (Fig. 2). A narrow road intersects Duncan Creek road and winds southeast along the northern shoreline of Mayo Lake as far as Keystone Creek. A four-wheel drive road and a narrow bridge crossing Mayo River join Davidson Creek to the Mayo Lake road. Mayo Lake tributaries Anderson and Ledge creeks are accessed in winter by an ice road while in the summer access is restricted to boats, barges and aircrafts, which can utilize a small airstrip on Ledge Creek.

Physiography

Mayo Lake is the largest water body in central Yukon with a length of over 30 km (Fig. 30), and it consists of the West, Roop (east) and Nelson (south) arms. Several narrow streams occupy canyons above Mayo Lake and form alluvial fan-deltas where they empty into the water body. The main discharge point of Mayo Lake is through Mayo River from the West arm. Davidson Creek empties into Mayo River just west of the outlet from Mayo Lake. The Gustavus Range (including Mt. Albert at 6500 ft, 2000 m a.s.l.) rises steeply to the north while wide, glaciated valleys extend from each of the lake's three arms.

Local geology

The Robert Service Thrust Fault crosses Mayo Lake from northwest to southeast, separating Upper Proterozoic to Lower Cambrian Hyland Group from Mississippian Keno Hill Quartzite and Devono-Mississippian Earn Group (Murphy, 1997). The Roop Lakes stock is Cretaceous hornblende-biotite granite, which subcrops a few kilometres north of the Roop arm (Murphy, 1997). Between the Roop and South arms, the Mayo Lake antiform dominates the Fork Plateau. A small galena vein

(Yukon MINFILE 1997, 105M 047) occurs on the north shore of Mayo Lake on Mt. Albert.

Surficial geology

Much of the topography surrounding Mayo Lake is covered by colluviated bedrock and till. Glacial erosion dominated in the Roop Arm (north arm) and no glacial deposits were observed in this area except near the McConnell glacial limit at 4000 ft (1200 m). A sizeable alluvial fan-delta developed at the mouth of Edmonton Creek and smaller fan-deltas were observed on the north shore. On the Nelson Arm to the south, a blanket of glacial till and meltwater deposits were noted near Ledge Creek to elevations of 2600 ft (790 m). The west shore of the Nelson Arm is generally steep with few surficial deposits other than colluviated bedrock. Well-developed alluvial fan-deltas form at the mouths of streams entering the lake. The west-end of Mayo Lake, after the confluence of the Roop and Nelson arms, has few surficial deposits until the valley widens at the west-end of the lake. An elevated ice-marginal outwash deposit (Kame terrace) parallels the north shore of the lake from Keystone Creek to Pingpong Creek (Bond 1998d, in pocket). A large alluvial fan-delta complex at the mouth of Keystone Creek

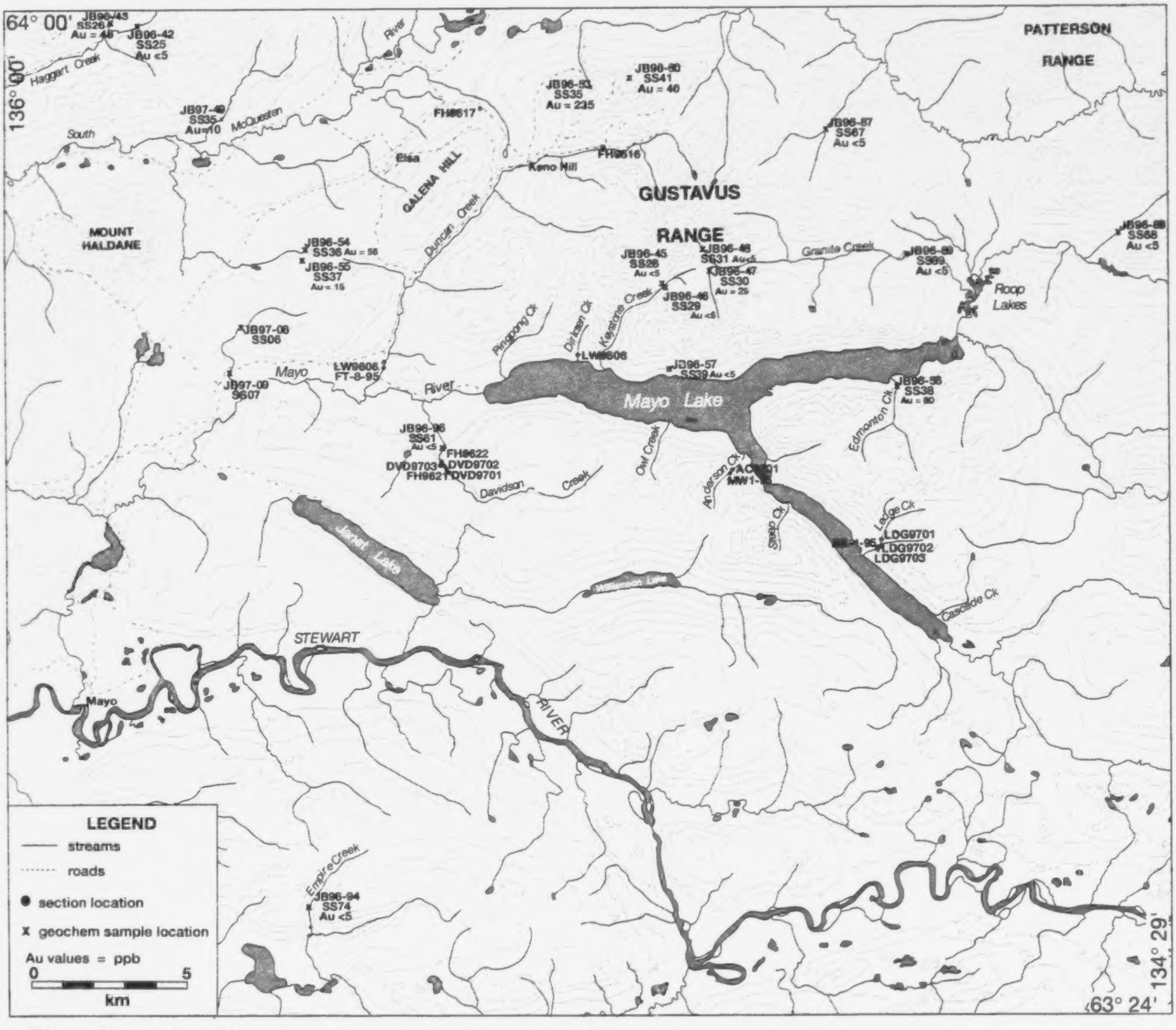


Figure 30. Section and geochemical sample locations, Mayo Lake area.

consists of two remnant fan-delta terraces on either side of the active fan-delta (Fig. 31). The abandoned fan-deltas mark a period closer to the end of the last glaciation when the lake level was higher. Evidence of a higher lake level is also preserved as elevated lake sediments at the west end of the lake. Till blankets and complexes of outwash gravel and meltout till line the Mayo River valley. Large alluvial plains dissect the glacial deposits and form broad floodplains and terraces in the base of the valley (Bond, 1998d, in pocket).

Sedimentology

Introduction

Thirteen sections were examined in detail in the Mayo Lake area between 1995 and 1998. Sections were located at active mining cuts and stream cutbanks on Anderson, Ledge, Dirksen and Davidson creeks. Figure 30 shows the location of the sections; these are summarized in Appendix 1b.

Dominant Facies and Interpreted Environments of Deposition

Mayo Lake lies completely within the Reid ice limit, and its tributary creeks were glaciated nearly to their headwaters during the McConnell. Anderson Creek, Ledge Creek and most of the other tributaries of Mayo Lake have formed alluvial fan-deltas into Mayo Lake. Dominant facies include glacially derived Facies 1 (massive boulder-cobble diamict – Dmm) and Facies 2 (weakly stratified boulder-cobble-pebble diamict - Dms), as well as glaciolacustrine and lacustrine-derived Facies 11 (laminated and rippled sand, silt and mud - Flr). Fan-delta sediments include Facies 3 (weakly stratified/imbricated boulder gravel – Gms), Facies 5 (stratified/cross-stratified gravel - Ghpt), Facies 6 (massive to stratified pebbly fine

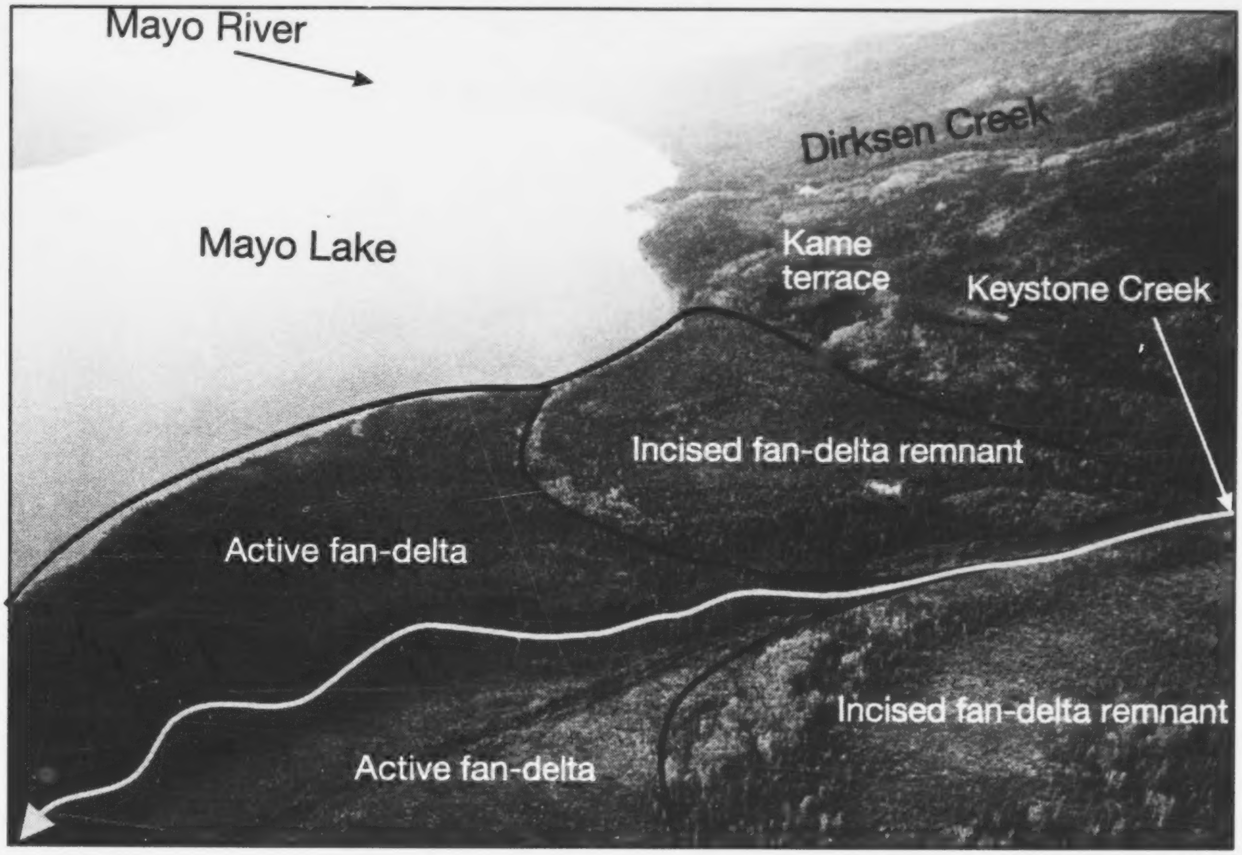


Figure 31. *View looking west of a large alluvial fan-delta complex at the mouth of Keystone Creek. Two fan-delta terraces are preserved as remnants on either side of the incised active fan-delta.*

sand – Sh), Facies 7 (planar tabular cross-bedded pebbly fine sand – Sp) and Facies 9 (ripple cross-bedded sand – Sr). On Ledge Creek Facies 3 is the main pay unit – it was interpreted to be an interglacial alluvial fan gravel which is overlain by McConnell glacial till (Facies 1) and glaciolacustrine sediments (Facies 11).

Stratigraphy

Representative stratigraphic sections

Figure 32 is a panel diagram depicting measured section AC9701 on Mayo Lake tributary Anderson Creek, while Figure 33 depicts measured section RB 95-1 on Mayo Lake tributary Ledge Creek. Additional sections are located in Appendix 4.

Lithostratigraphic asemblages

Five lithostratigraphic assemblages are found in the Mayo Lake area; a representation of these is shown in Figure 34, which is a schematic cross-valley profile. They are as follows:

- Assemblage 4 – Post-Reid (Koy-Yukon) interglacial alluvium;
- Assemblage 5 – Early and Middle McConnell periglacial sediments;
- Assemblage 6 – McConnell glacial sediments;
- Assemblage 7 – Late McConnell periglacial sediments; and
- Assemblage 8 – Holocene alluvial sediments.

Stratigraphic relationships

Lithostratigraphic Assemblage 4 – Post-Reid (Koy-Yukon) interglacial alluvium

This assemblage occurs mainly on bedrock in tributaries to Mayo Lake, where it forms part of the alluvial fans which build into Mayo Lake. On Ledge Creek, a wood sample (LDG 9703-01A) from a boulder gravel unit within this assemblage produced a ^{14}C date of 30 450 ± 340 B.P (see Table 7).

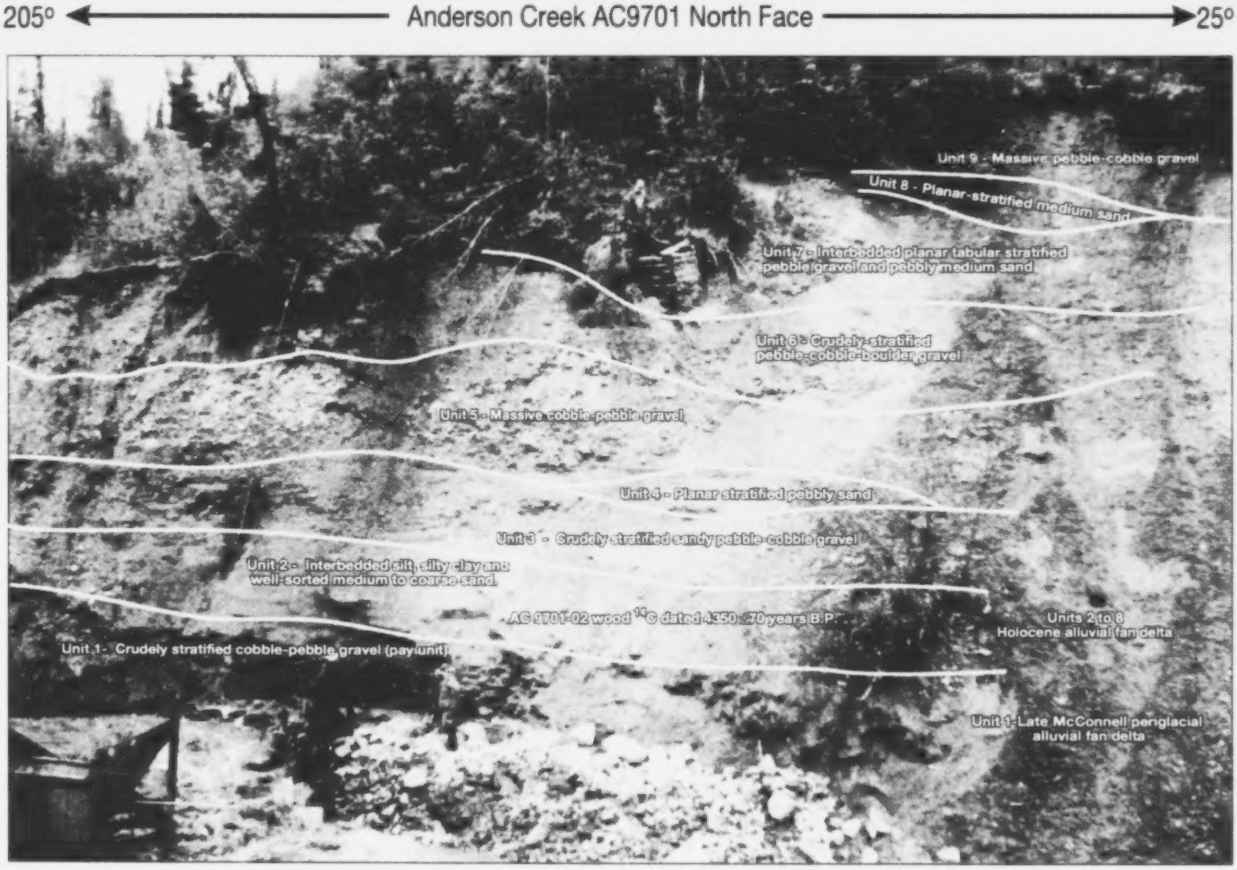

205° ← Anderson Creek AC9701 North Face → 25°
Unit 9 - Massive pebble-cobble gravel
Unit 8 - Planar-stratified medium sand
Unit 7 - Interbedded planar tabular stratified pebble gravel and pebbly medium sand
Unit 6 - Crudely-stratified pebble-cobble-boulder gravel
Unit 5 - Massive cobble-pebble gravel
Unit 4 - Planar stratified pebbly sand
Unit 3 - Crudely stratified sandy pebble-cobble gravel
Unit 2 - Interbedded silt, silty clay and well-sorted medium to coarse sand.
AC 9701-02 wood ¹⁴C dated 4350 ± 70 years B.P.
Unit 1 - Crudely stratified cobble-pebble gravel (pay unit)
Units 2 to 8 Holocene alluvial fan delta
Unit 1-Late McConnell periglacial alluvial fan delta

***Figure 32.** Panel diagram of Anderson Creek mining section showing typical alluvial fan delta stratigraphy. Alternating units of fluvial channel gravel, overbank organic silt and sand, fine-grained lake sediments and deltaic sands are characteristic.*

Table 7. Radiocarbon dates for organic sediments, Mayo Lake.

Unit number	Sample number	Location	^{14}C Date (type)	Comments
LDG9703-01	Beta-109149	Ledge Creek	30 450 ± 340 (conventional)	Unit 1a organics
AC9701-02	Beta-109153	Anderson Creek	4350 ± 70 (conventional)	Unit 2 organics

Lithostratigraphic Assemblage 5 – Early and Middle McConnell periglacial sediments

On Mayo Lake tributaries, Assemblage 5 occurs either on bedrock or unconformably upon gravelly units of Assemblage 4. It may contain reworked elements of Assemblage 4, and lies disconformably beneath sediments of Assemblage 6, as it was deposited prior to ice advance.

Lithostratigraphic Assemblage 6 – McConnell glacial sediments

Assemblage 6 lies disconformably over Assemblages 5 and 4, generally on slopes, terraces and plateaus within the McConnell glacial limit. In Davidson Creek, silt and clay from this assemblage line the valley, where it is reworked and cut by sediments of Assemblage 8.

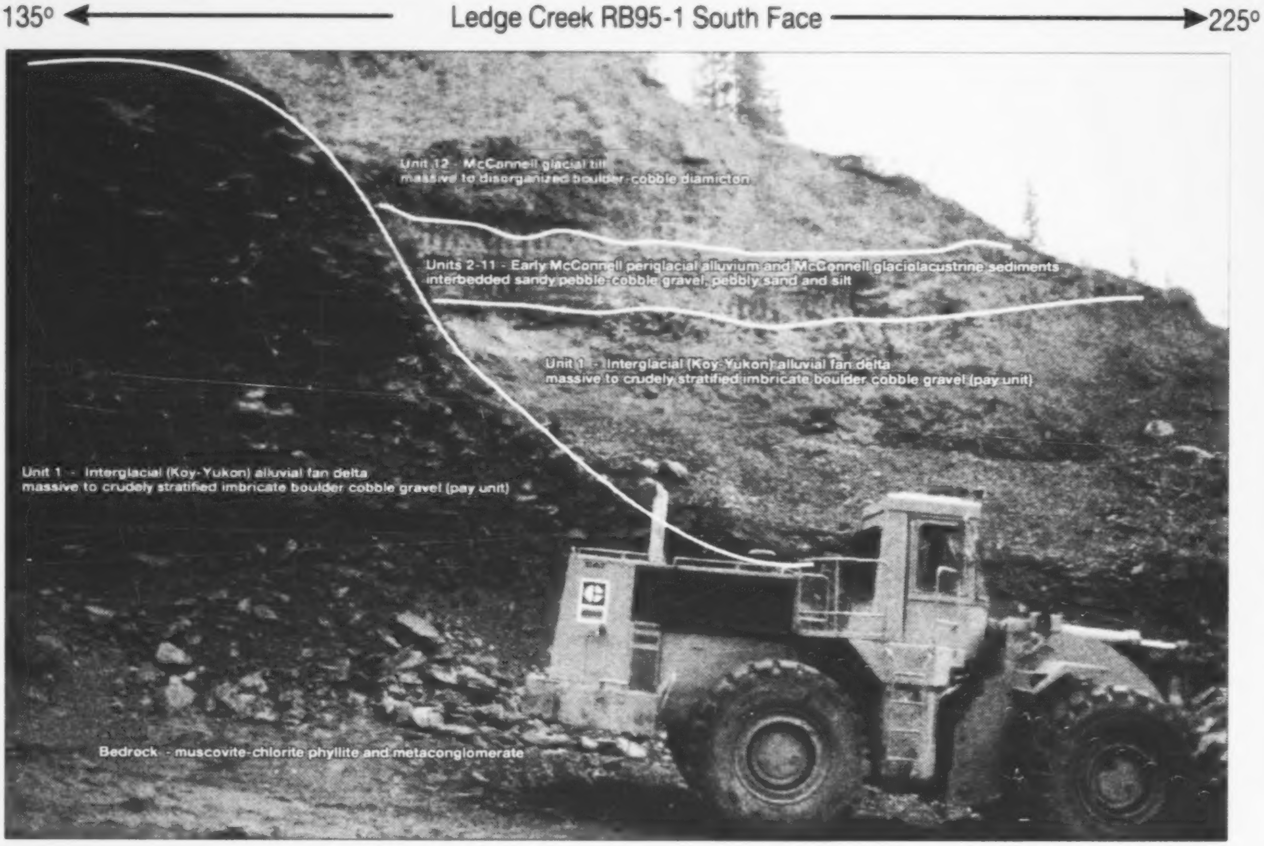

135° ← Ledge Creek RB95-1 South Face → 225°
Unit 12 - McConnell glacial till
massive to disorganized boulder-cobble diamicton
Units 2-11 - Early McConnell periglacial alluvium and McConnell glaciolacustrine sediments
interbedded sandy pebble-cobble gravel, pebbly sand and silt
Unit 1 - Interglacial (Koy-Yukon) alluvial fan delta
massive to crudely stratified imbricate boulder cobble gravel (pay unit)
Unit 1 - Interglacial (Koy-Yukon) alluvial fan delta
massive to crudely stratified imbricate boulder cobble gravel (pay unit)
Bedrock - muscovite-chlorite phyllite and metaconglomerate

Figure 33. *Measured section RB1-95 on Ledge Creek showing interglacial (pre-McConnell) alluvial fan-delta gravel overlain by McConnell glaciolacustrine silt and glacial till. Interglacial gravel is typically gold-bearing, coarse grained and very poorly sorted.*

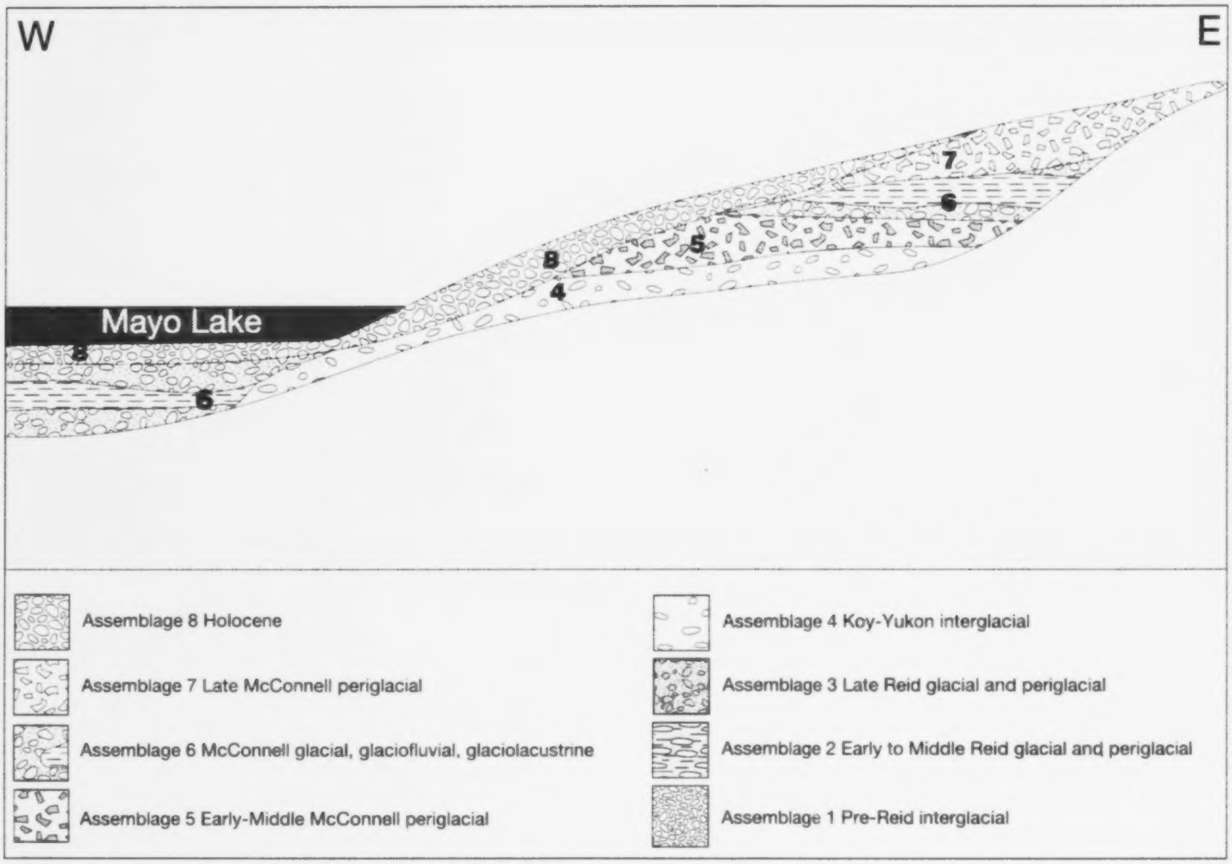

W
E
Mayo Lake
8
6
8
4
5
7
6
Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial and periglacial
Assemblage 1 Pre-Reid interglacial

Figure 34. *Schematic cross-valley profile of Mayo Lake tributaries. Not to scale.*

Lithostratigraphic Assemblage 7 – Late McConnell periglacial sediments

McConnell periglacial alluvial fan sediments were noted outside of McConnell ice limits along Mayo Lake these fans were probably deposited continuously throughout the McConnell glaciation, depositing sediments of Assemblage 7 on top of Assemblage 6.

Lithostratigraphic Assemblage 8 – Holocene alluvial, colluvial and eolian sediments

In the canyon of Davidson Creek, Holocene alluvial gravel lies unconformably upon McConnell glacial sediments and bedrock (see also Fig. 35). On Mayo Lake tributaries, they crosscut or overlie all earlier assemblages including McConnell glacial and periglacial sediments and earlier interglacial alluvium. On Anderson Creek, organic debris from within alluvial fan delta sediments yielded a ^{14}C age of 4350 ± 70 years B.P (see Table 7).

Paleogeographic history

The glacial history of Mayo Lake was controlled by its confining physiography. Ice lobes entering the Roop and Nelson arms eroded the valley walls until deglaciation when meltout till and outwash were deposited on the lower flanks of the valleys. Erosional scars from meltwater channels occur on all the slopes bordering the lake and may contain minor outwash deposits. All streams flowing into Mayo Lake enter the lake at a transverse angle and have a v-shaped morphology, which suggests they were spared of glacial erosion. Small cirques at the headwaters of Edmonton Creek would have contained small glaciers during the last glaciation, however cirques at the headwaters of Steep Creek are likely Reid age, based on their orientation and amount of dissection. Glacial deposits are more abundant at the headwaters of Mayo River where the valley widens. Distinct lateral moraines can be traced from this point into Duncan and Davidson creeks. Excessive glacial deposition in Mayo River valley caused damming and the formation of Mayo Lake.

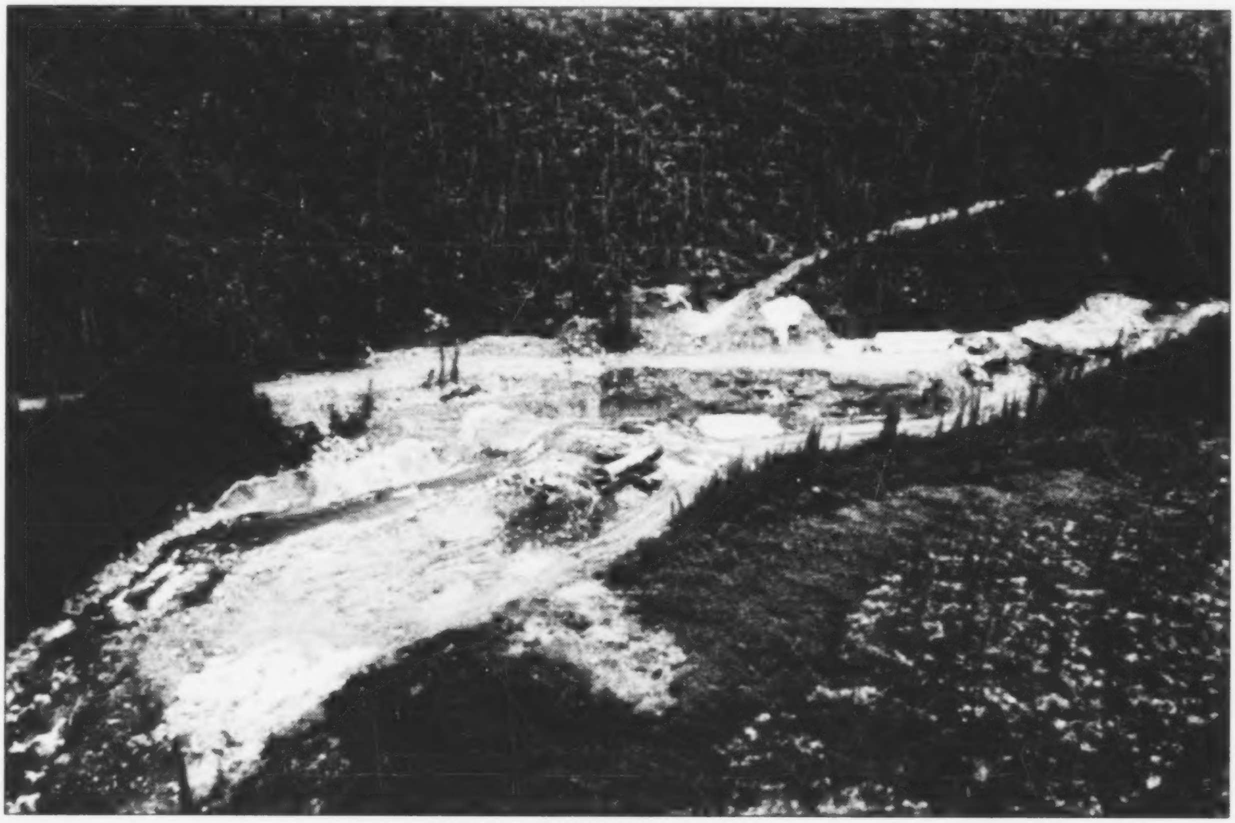


Figure 35. In 1996, Rivest Mining had a placer operation just above the canyon on Davidson Creek. Placer gold-bearing gravels were found on a low terrace on bedrock, and within a silty clay layer which may be McConnell glaciolacustrine sediment.

Placer geomorphology

The morphology of tributary valleys to Mayo Lake was influenced by glacial erosion, particularly in the Nelson and Roop arms. The sides of the main valley were selectively eroded by the glacier, creating a u-shaped valley, which contrasts with the v-shaped valleys of the tributaries. Widening of the trunk valley also makes the tributary valleys appear less incised. Above the glacial limit, or at least above the limit of glacial erosion, the tributary streams have an incised and well-confined drainage pattern, and within the glacial limit the drainage pattern is shallower and more exposed. Keystone Creek valley is the only tributary that has a well-incised morphology near its junction with Mayo Lake valley, and this is likely due to its length and a higher than average amount of discharge.

In spite of the glacial erosion in Mayo Lake valley, however, several placer deposits have been found in tributary valleys. These placers are of three types: interglacial (pre-McConnell) alluvium found in narrow valleys and canyons above the alluvial fan-deltas (Lithostratigraphic Assemblage 4, which was subsequently buried by McConnell glacial sediments); McConnell age periglacial alluvial fan deposits which formed placers on bedrock and at the apex of the alluvial fan-deltas (Lithostratigraphic Assemblage 7); and modern alluvium in tributary valley canyons and fan-delta apexes (Lithostratigraphic Assemblage 8).

Placer gold deposits occur on Anderson Creek at the apex of the fan-delta and on bedrock on the distal fan; and most, if not, the entire fan is comprised of sediments of Lithostratigraphic Assemblage 8 (Fig. 36). Conversely, Ledge Creek placer deposits also include interglacial sediments of Lithostratigraphic Assemblage 4, which were buried and preserved by McConnell glacial drift (Fig. 37). Several other alluvial fan-deltas extending into Mayo Lake may have similar settings; further exploration of these tributaries is warranted.

Davidson Creek lies partially within the McConnell glacial limit and the valley morphology is a result of a glacial diversion above the canyon. Prior to the last glaciation, upper Davidson Creek flowed south to Janet Lake (Fig. 30). Lower Davidson Creek at this time had a more local drainage pattern and the canyon was likely less developed or absent. When McConnell ice in Janet Lake Valley reached its maximum extent meltwater was diverted over the low divide northward into the Mayo River valley. More rapid erosion formed a canyon and ensured the northward course. Glacial outwash blankets upper Davidson Creek near the diversion.

The origin of gold in the canyon of lower Davidson Creek is unknown, although, its flattened morphology suggests that it is moderately travelled (Kreft, 1993). If placer gold were found near the point of diversion, just inside the canyon (meltwater channel), this would suggest an upstream source. Placer gold deposits do not normally originate in meltwater channels that were not previously occupied by an interglacial stream. If the gold originated in the headwaters of Davidson Creek, as current geomorphology suggests, then a large part of this drainage basin warrants exploration. The broad outwash plain near the head of the canyon was created by meltwater from the impinging Janet Lake ice lobe. Further prospecting should attempt to identify more locally derived gravel below the glacial outwash if it escaped McConnell erosion. If found, this paleochannel representing upper Davidson Creek prior to the McConnell diversion should extend southward toward Janet Lake.

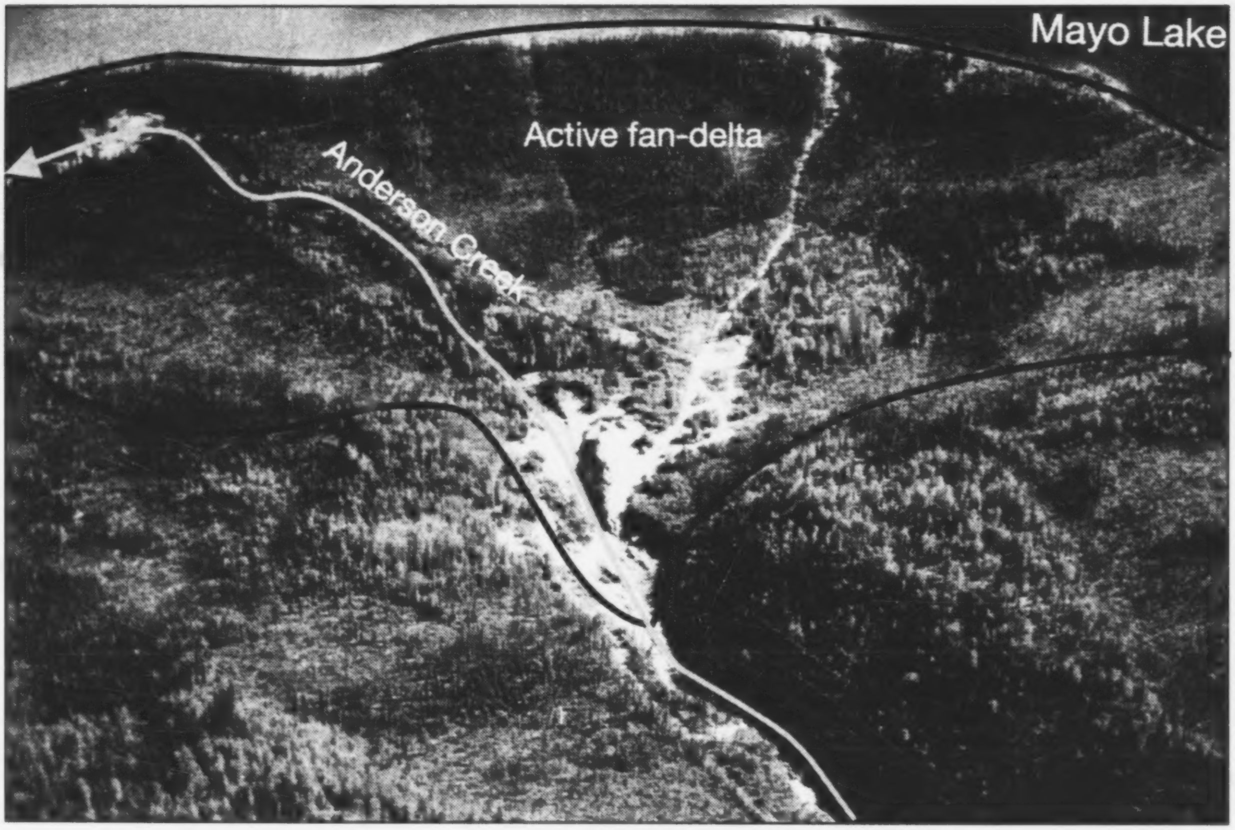


Figure 36. This photo taken in 1995 shows a Holocene alluvial fan-delta which has formed on Anderson Creek, a Mayo Lake tributary. Most placer mining activity has been near the fan apex, and on bedrock farther down the fan.

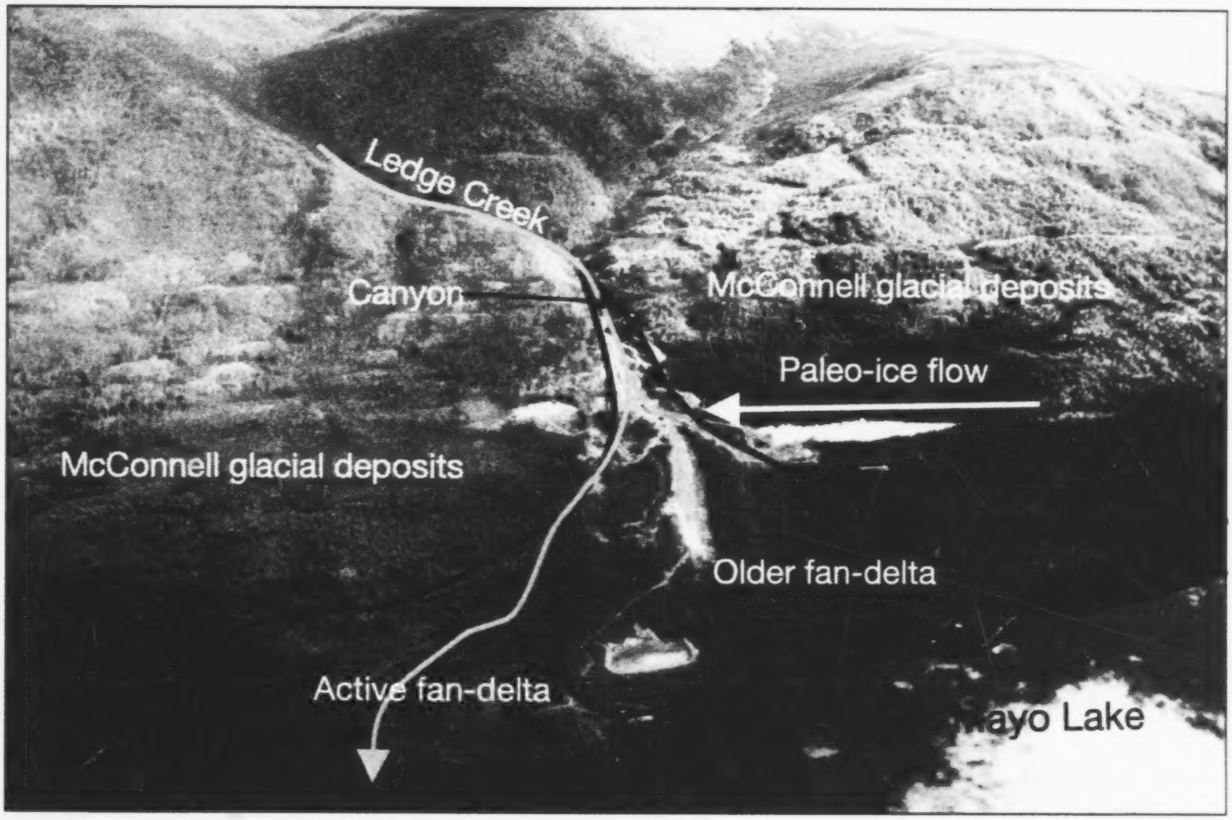


Figure 37. *On Ledge Creek, interglacial alluvial fan sediments, comprising an older fan-delta, were reworked and partially buried by McConnell glacial deposits. Since the canyon above the fan-delta is oriented transverse to paleo-ice flow, placer gold-bearing gravels were protected from glacial erosion. An active fan-delta has since formed after the glacier retreated.*

HIGHET CREEK/MINTO LAKE

Introduction

Although production was reported on Johnson Creek as early as 1894, the Discovery claim on Johnson Creek was staked by F. Johnson in 1898. This initiated a small stampede resulting in 38 prospectors staying the winter. Groundwater problems resulted in abandonment of the creek until a brief resurgence of activity in 1915. From 1958 to 1967, mining was conducted by Bardusan Placers, and in 1976, C. and H. Klippert Ltd. began mining. Bardusan Placers later returned, mining from 1980 to 1991. The total placer gold production from Johnson Creek is reported to be 13,280 crude ounces (411 700 g.).

Mining activity began on Highet and Minto creeks in 1903. The bench deposit on the right limit of Highet Creek proved to be the richest ground, especially near Rudolph Gulch, where over 6773 fine ounces (210 700 g) of gold were recovered. In 1920-21, an attempt was made to dredge Highet Creek, which was ultimately unsuccessful due to the large amount of boulders uncovered.

Recorded placer gold production from Highet and Minto creeks and their tributaries to 2000 is over 48,000 crude ounces (1.5 million g).

Location and access

The Minto Lake drainage area is located on NTS map sheets 115P/9 and 115P/16. The main drainages in the area are Minto, McIntyre, McLagan, Highet, Sabbath and Johnson creeks (Figs. 38 and 39). The road to Highet and Minto creeks begins 15 km along the Silver Trail, north of Mayo. It winds west for another 5 km before dividing into a northern road, which climbs the Highet Creek valley, and a southern road, which follows Minto Creek to Minto Lake. Both roads are two-wheel drive accessible in the summer months.

Physiography

The Highet Creek/Minto Lake area consists of a large incised plateau bounded by broad, u-shaped, glaciated valleys, including the South McQuesten River to the north. In the southern part of the field area near Minto Lake, North and South Bear creeks and Moose Creek, underfit streams flow in wide valleys that were modified during the Reid glaciation and subsequently filled with glaciofluvial outwash during the McConnell glaciation.

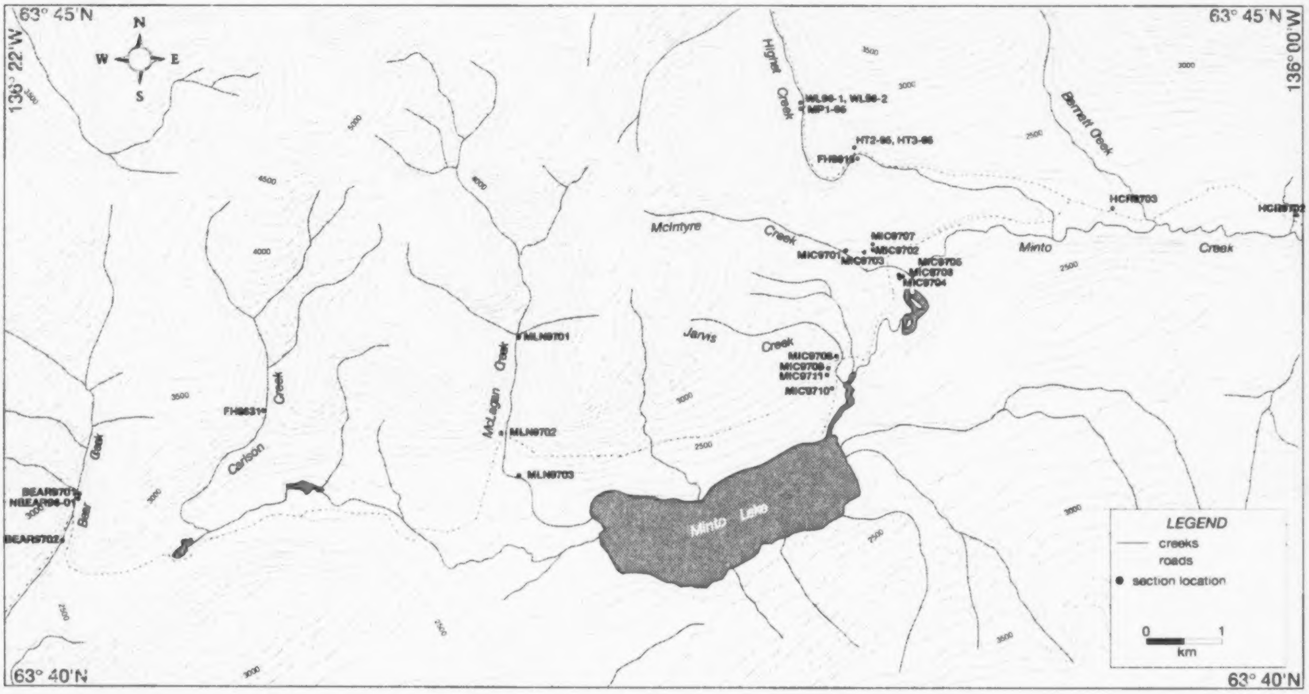


Figure 38. Minto Lake and southern reaches of Highet Creek showing locations of measured sections.

Local geology

The Robert Service Thrust Fault crosses north of the map area at Seattle Creek, where it divides Upper Proterozoic to Lower Cambrian Hyland Group from Mississippian Keno Hill Quartzite and Devono-Mississippian Earn Group (Murphy, 1997). Cretaceous hornblende granodiorite intrudes Hyland Group phyllite on the uplands between Highet Creek and Seattle Creek, and between Highet Creek and Minto Lake (Murphy, 1997).

The Scheelite Dome tungsten-gold skarn deposit and the Hawthorne Sb-Au vein ((Yukon MINFILE, 1997, 115P 004, 115P 003) are the main mineral occurrences in the headwaters of these two creeks.

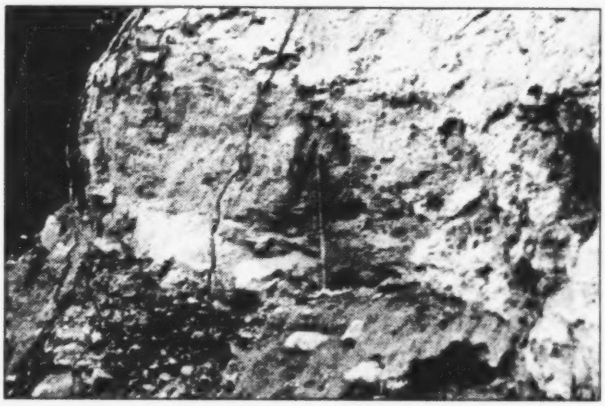


Figure 40. *Measured section MIC9710 near Minto Creek, where a Diversion Creek paleosol is preserved on a Reid glaciofluvial terrace. This yellow-brown paleosol was subsequently buried by a McConnell age periglacial debris flow and protected from further erosion.*

Surficial geology

Thick deposits of glacial till, lacustrine and outwash sediments characterize the surficial geology of the Minto Creek valley. McConnell till lines the lower part of the drainage basin and McConnell outwash sediments extend west to Minto Lake. Reid glacial till, lacustrine and outwash sediments line the valley beyond the McConnell limit and form a distinct terrace between Minto Lake and Highet Creek (Fig. 40). All tributaries to Minto Creek are incised into the glacial deposits where they intersect the valley. Mining exposures in Highet Creek, a tributary to Minto Creek, reveal Reid glacial deposits on the lower

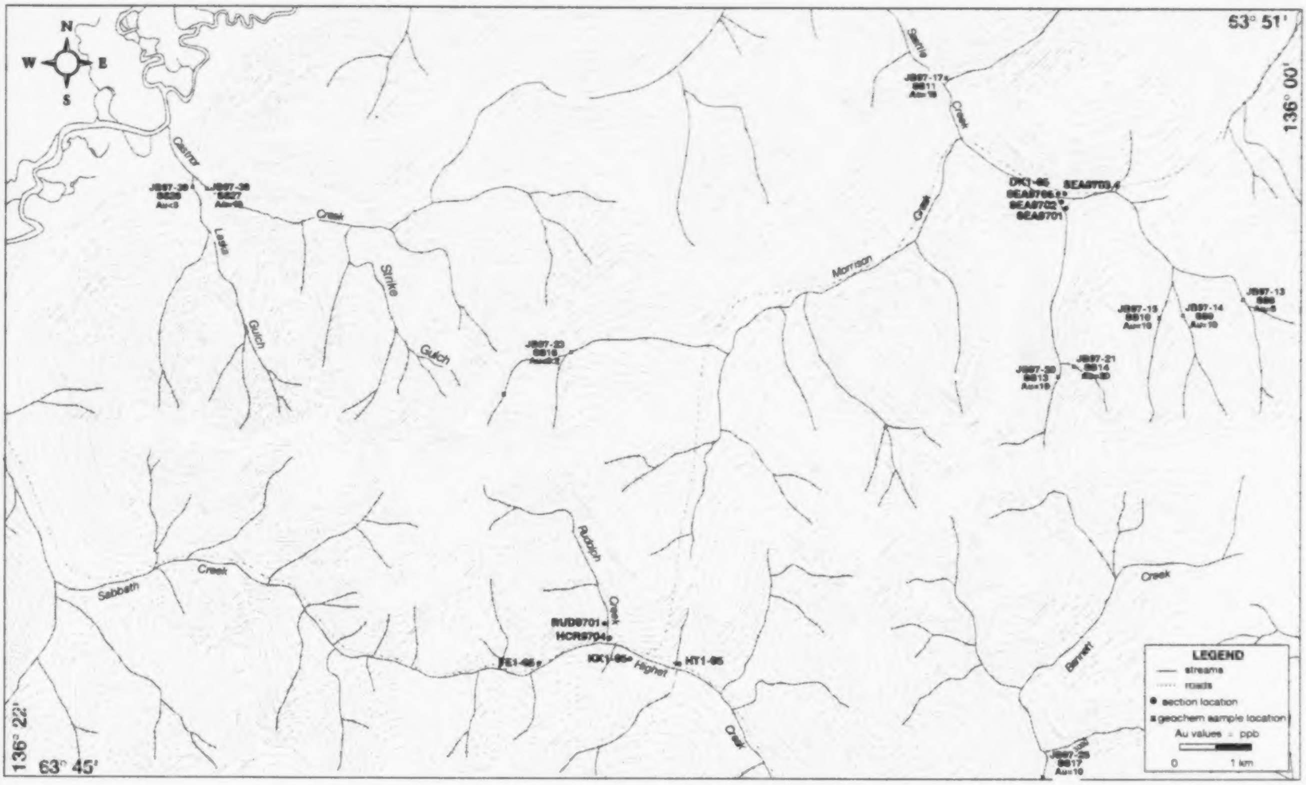


Figure 39. *Highet Creek and Seattle Creek showing locations of measured sections.*

slopes of the valley. Late or post-Reid downcutting and interglacial sedimentation have since emplaced younger sediments within the glacial maximum fill. Whether Bennett Creek and Roaring Fork Creek, the other two main tributaries to Minto Creek, have a similar stratigraphy is unknown. Both of these drainages have steeper slopes that appear to be void of thick glacial deposits. The lower reaches of Roaring Fork Creek have actually become incised due to the overdeepening of Minto Creek by the McConnell ice lobe.

Sedimentology

Introduction

Thirty sections were examined in detail in the Highet Creek and Minto Creek area between 1995 and 1998. Sections were located at active mining cuts, natural and road exposures and stream cutbanks. Figures 39 and 40 show the location of the sections; these are summarized in Appendix 1c.

Dominant facies and interpreted environments of deposition

Highet and Minto creeks are completely outside of the McConnell ice limit but were ice-covered during the Reid glaciation, which deposited high level terraces above Minto Creek and in the lower reaches of Highet Creek as glaciofluvial complexes. These complexes include sediments of Facies 1 (massive boulder-cobble diamict – Dmm), Facies 3 (weakly stratified/imbricated boulder gravel – Gms), and Facies 11 (laminated and rippled sand, silt and mud - Flr). Holocene valley fill gravels occur mainly in the valley centres of Highet and Minto creeks, and dominant sediments include Facies 5 (stratified/cross-stratified gravel - Ghpt), Facies 6 (massive to stratified pebbly fine sand – Sh), Facies 7 (planar tabular cross-bedded pebbly fine sand – Sp) and Facies 9 (ripple cross-bedded sand – Sr). Low-level late McConnell outwash terraces along Minto Creek contain well-stratified gravel of Facies 5 (Ghpt).

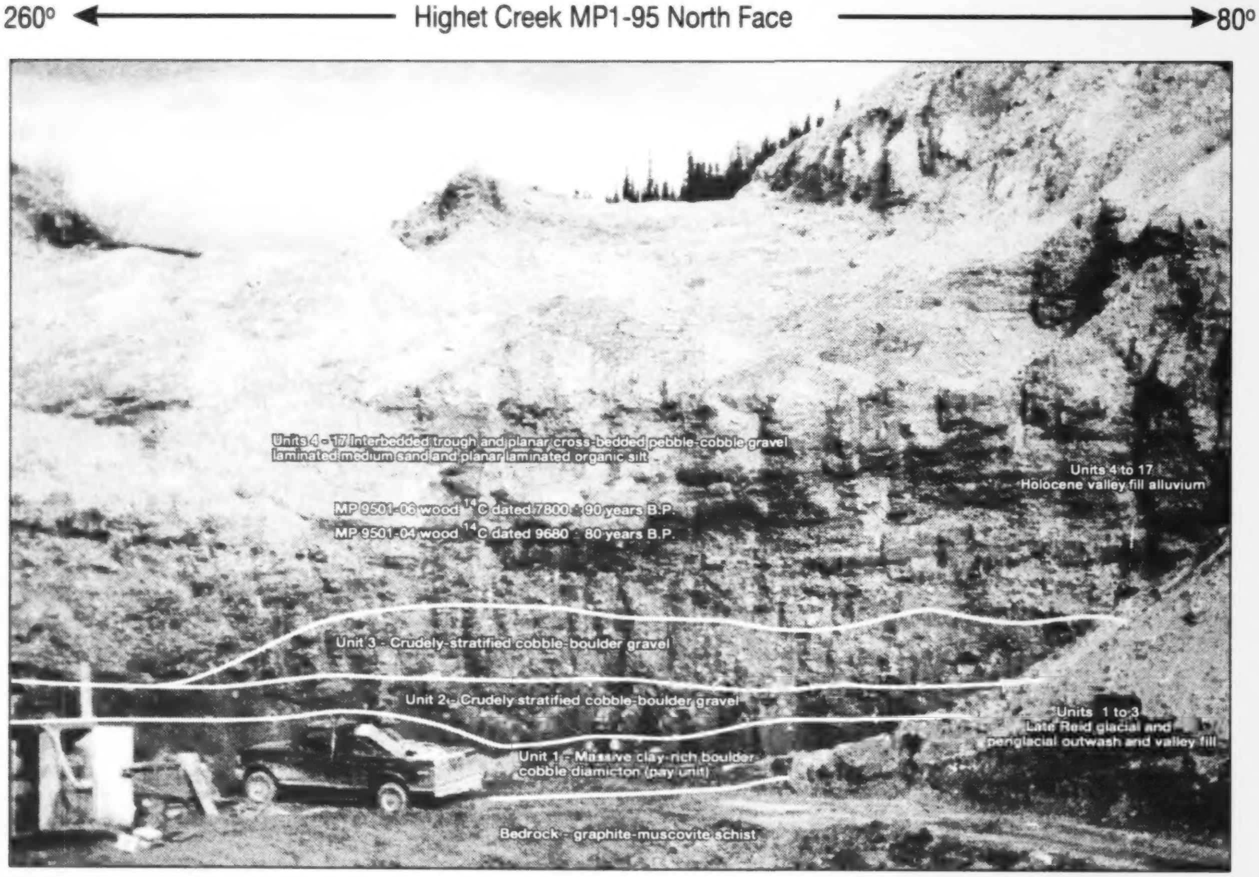

260°
Highet Creek MP1-95 North Face
80°
Units 4 - 17 Interbedded trough and planar cross-bedded pebble-cobble gravel laminated medium sand and planar laminated organic silt
MP 9501-06 wood ^{14}C dated 7800 ± 90 years B.P.
MP 9501-04 wood ^{14}C dated 9680 ± 80 years B.P.
Units 4 to 17 Holocene valley fill alluvium
Unit 3 - Crudely-stratified cobble-boulder gravel
Unit 2 - Crudely stratified cobble-boulder gravel
Units 1 to 3 Late Reid glacial and periglacial outwash and valley fill
Unit 1 - Massive clay-rich boulder cobble diamicton (pay unit)
Bedrock - graphite-muscovite schist

Figure 41. *Panel diagram showing typical stratigraphy on Highet Creek. Reid glacial till, outwash and periglacial sediments are unconformably overlain by Holocene creek gravel.*

Stratigraphy

Representative stratigraphic sections

Figure 41 is a panel diagram demonstrating typical stratigraphy in the Highet Creek/Minto Creek area (measured section MP1-95). Additional sections are located in Appendix 4.

Lithostratigraphic assemblages

Eight lithostratigraphic assemblages are found in the Highet Creek/Minto Creek area; a representation of these is shown in Figures 42 and 43, which are schematic cross-valley profiles.

They are as follows:

- Assemblage 1 – Pre-Reid interglacial sediments;
- Assemblage 2 – Early to Middle Reid glacial, periglacial and glaciolacustrine sediments;
- Assemblage 3 – Late Reid glacial and periglacial sediments;
- Assemblage 4 – Post-Reid (Koy-Yukon) interglacial alluvium;
- Assemblage 5 – Early and Middle McConnell periglacial sediments;
- Assemblage 6 – McConnell glacial, glaciofluvial and glaciolacustrine sediments;
- Assemblage 7 – Late McConnell periglacial sediments; and
- Assemblage 8 – Holocene alluvial sediments.

Stratigraphic relationships

Lithostratigraphic Assemblage 1 – Pre-Reid interglacial sediments

This assemblage occurs in the lower reaches of Highet Creek as crudely stratified cobble gravel where it is unconformably overlain by Early to Middle Reid glacial and glaciolacustrine sediments of Assemblage 2 (measured sections HT2-95, HT3-95).

Lithostratigraphic Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments

This assemblage was found in several exposures that were studied on Minto and Highet creeks, which included measured sections HT2-95, HT3-95, MIC9701, MIC9702, MIC9703, MIC9707 and MIC9711. Glaciofluvial outwash and glaciolacustrine silt capped by glacial till form high-level terraces along Minto Creek and the lower reaches of Highet Creek.

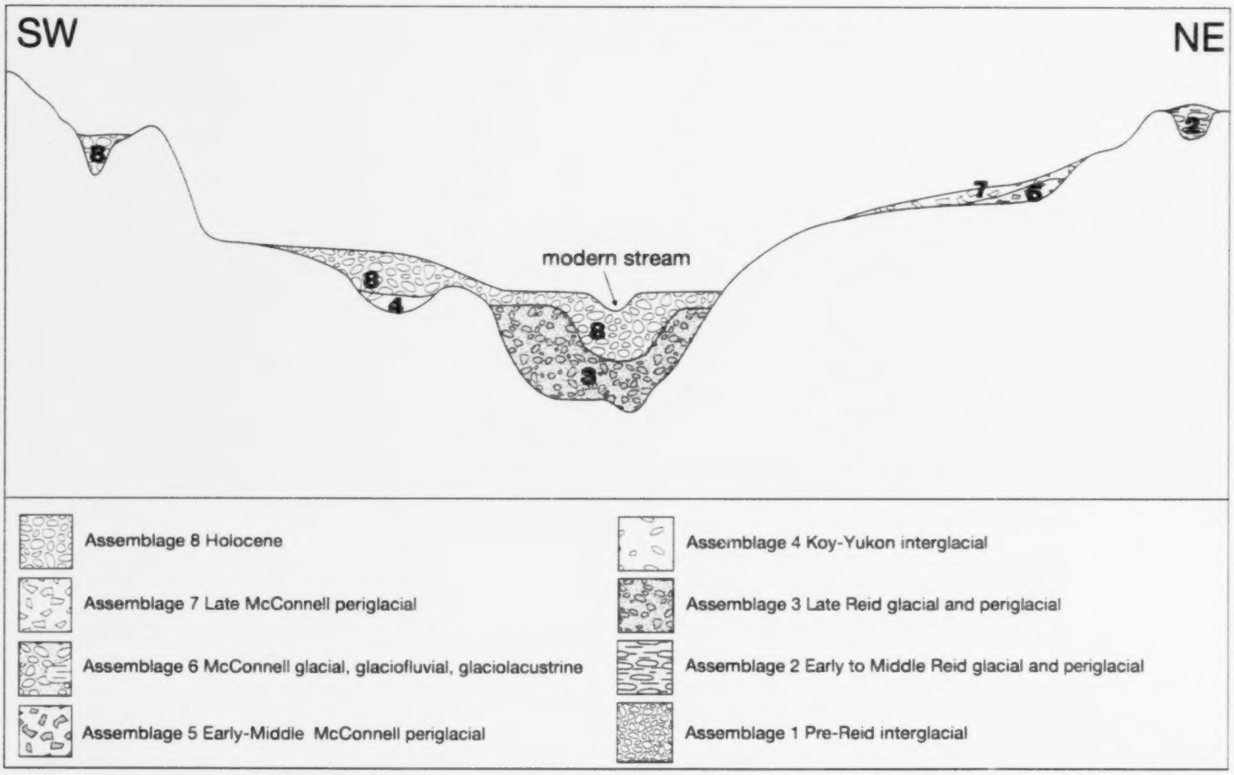

SW
NE
8
2
7
6
modern stream
8
4
8
3
Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial and periglacial
Assemblage 1 Pre-Reid interglacial

***Figure 42**. Schematic cross-valley profile of Highet Creek, illustrating relationships between lithostratigraphic assemblages.*

Lithostratigraphic Assemblage 3 – Late Reid glaciofluvial, glacial and periglacial sediments

Diamict of Assemblage 3 lines the valley floor in both Highet and Minto creeks, and appears to form a mid-level terrace on the valley side of Minto Creek. This assemblage is incised into sediments of Assemblage 2 in the main valley of Minto Creek, as it commonly occurs in a low stratigraphic position near bedrock. These terraces likely formed during the late or retreat phase of the Reid glaciation.

Lithostratigraphic Assemblage 4 – Post-Reid (Koy-Yukon) interglacial alluvium

This assemblage was found on the right limit of Highet Creek where it formed an alluvial terrace (measured section KK1-95), which is overlain by colluvium of Assemblage 8. On Minto Creek, this assemblage is represented by a Diversion Creek paleosol that developed on sediments of Assemblage 3 and buried by periglacial sediments of Assemblage 5 (measured section MIC9710 – Fig. 40).

Lithostratigraphic Assemblage 5 – Early and Middle McConnell periglacial sediments

These periglacial sediments formed during the McConnell glaciation but lie outside the ice limits and glaciofluvial meltwater flow. On Highet Creek, periglacial sedimentation was noted in measured section HT1-95. In Minto Creek, periglacial debris flows and alluvial fans have resedimented Reid glacial sediments of Assemblage 2 and preserved a Diversion Creek paleosol (measured section MIC9710).

Lithostratigraphic Assemblage 6 – McConnell glacial sediments

This assemblage is found in the valley of Minto Creek as low-level gravel terraces, which incise into Reid glacial sediments and locally lie directly in contact with bedrock.

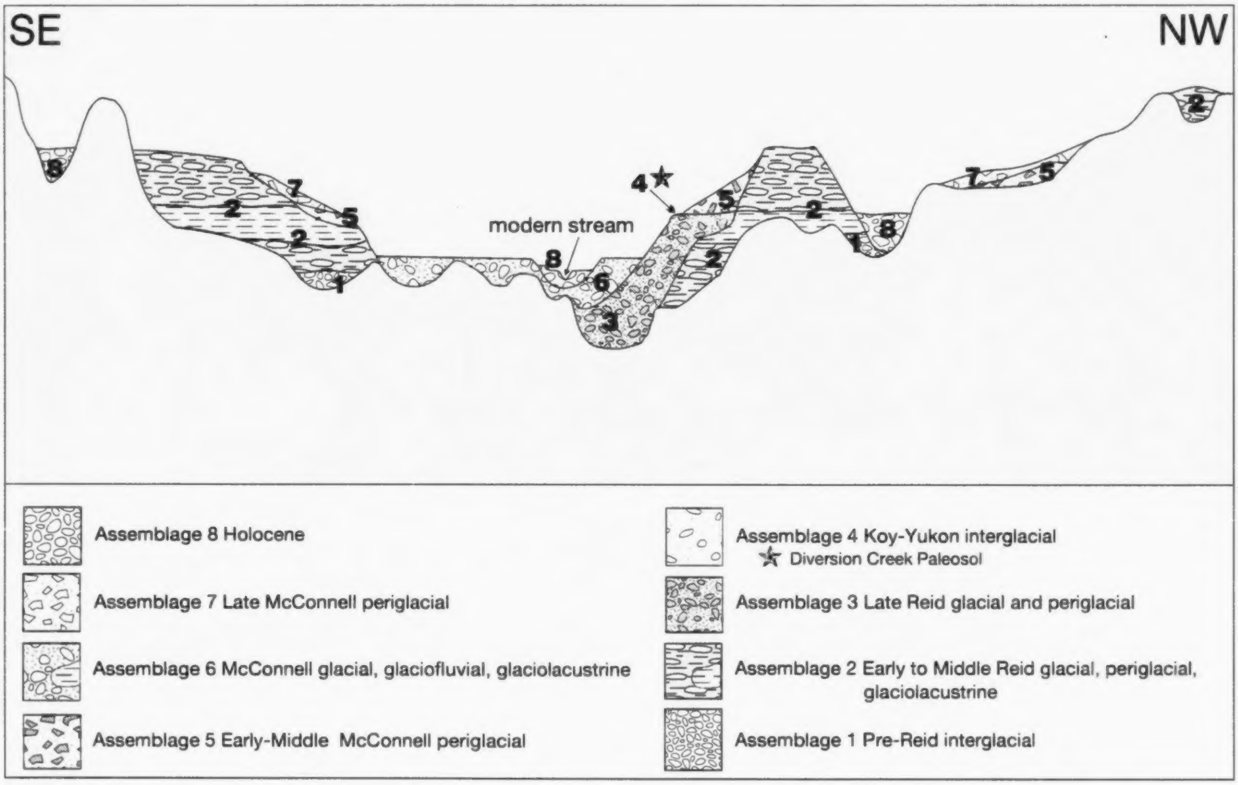

SE
NW
8
7
2
5
2
1
modern stream
8
6
3
4★
5
2
2
1
8
7
5
2
Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
★ Diversion Creek Paleosol
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial, periglacial, glaciolacustrine
Assemblage 1 Pre-Reid interglacial

Figure 43. *Schematic cross-valley profile of Minto Creek, illustrating relationships between lithostratigraphic assemblages.*

Table 8. Radiocarbon dates for Holocene sediments, Highet/Minto creeks.

Unit number	Sample number	Location	^{14}C Date (type)	Comments
MP1-95-4	Beta-86848	Highet Creek	9680 ± 80 (conventional)	Unit 4a wood
MP1-95-4	Beta-86849	Highet Creek	7800 ± 90 (conventional)	Unit 4b wood
FE1-95-2	Beta-86850	Highet Creek	6190 ± 90 (conventional)	Unit 2 wood

Lithostratigraphic Assemblage 7 – Late McConnell periglacial sediments

This assemblage was deposited continuously throughout the McConnell glaciation and lies conformably in contact with periglacial sediments of Assemblage 5.

Lithostratigraphic Assemblage 8 – Holocene alluvial, colluvial and eolian sediments

In Minto Creek, Holocene stream gravels lie adjacent to the modern stream. In Highet Creek, Holocene stream gravels (Table 8) of this assemblage incise into sediments of Assemblage 3, and form gulch gravels in higher reaches. Modern gulch gravels have also incised into sediments of Assemblage 1 and 2 in the lower reaches of Highet Creek.

Paleogeographic history

During the Reid and pre-Reid glaciations the Cordilleran ice sheet inundated the Minto area. The Reid limit reaches approximately 4200 ft (1280 m) on Scheelite Dome, just north of Minto Creek. The passage of ice through the area was from the Mayo River valley, up Minto Creek, and down the Moose and Bear Creek drainages. Ice entering Minto Creek was probably part of the valley glacier flowing south from Haldane Creek valley. Its flow pattern up the Minto drainage was likely assisted by the compressive forces of three lobes coming together in the Mayo River valley at the mouth of Minto Creek. They consisted of the Mayo River lobe, Janet Lake lobe, and the Haldane lobe. Because the Mayo River lobe and the Janet Lake lobe were advancing from east to west, and the Haldane lobe was flowing south, it was likely the Haldane lobe that was pushed west into the Minto Creek drainage. The glacial history of the Reid advance into the Minto valley is recorded in a section exposed at the mouth of Highet Creek (HT2-95, HT3-95). A proglacial lake developed in Highet Creek prior to the ice thickening and advancing over the glaciolacustrine sediments. The proglacial lake appears to have migrated up the Highet Creek drainage as the ice continued to thicken. This would have provided a mechanism to protect the pre-existing placers from glacial erosion.

Ice in Highet Creek eventually flowed into the Morrison Creek drainage where it merged with McQuesten valley ice. During deglaciation of Minto Creek, ice stagnated in the valley leaving thick blankets of sediment in the valley bottom and on the lower slopes. Meltwater channels are clearly evident on the benches between Highet Creek and Minto Lake. As the ice melted back towards the Mayo River valley, outwash eroded a channel through the thick fill in the valley bottom. This is most evident between Highet Creek and Minto Lake.

During the McConnell glaciation, ice terminated at the present day mouth of Minto Creek. Outwash flowed up the drainage and through the Minto Lake area to Moose Creek, further deepening the canyon cut through the Reid sediments and bedrock. The modern drainage has since downcut through the McConnell outwash surface leaving three distinct terraces in the bottom of the canyon.

Placer geomorphology

Highet Creek has historically been the main gold-producing creek in the Minto Creek drainage and continued to have active placer mining in 1999. One of the reasons for the richness of Highet Creek placer deposits is that interglacial alluvial deposits (Lithostratigraphic Assemblage 4), which had formed prior to the Reid glaciation, were protected from the advancing Reid ice sheet by a blanket of proglacial lake sediments. During the height of the Reid glaciation, the ice sheet advanced up Highet Creek but was unable to scour the buried interglacial sediments. With the retreat of the Reid glaciation and the initiation of downcutting in Minto Creek valley, a period of incision also began in Highet Creek. Throughout Highet Creek the sediment cover was eroded and the paleo-placers became reworked into the interglacial streambed. During the McConnell glaciation the base level of Highet Creek was affected again when erosive meltwater cut through Minto Creek valley. This caused a slight drop in base level at the mouth of Highet Creek and the stream began to downcut into the interglacial fill. When this occurred in the upper part of Highet Creek, where the interglacial fill was shallow, there was a complete reworking of the gravel and placers into the modern Holocene deposits. The only remnant of the interglacial streambed was a right limit bench (Fig. 44). In the lower part of the drainage, post-McConnell stream incision cut into the interglacial sediments but did not reach bedrock. Therefore, the interglacial placers on bedrock remained intact near the bottom end of the drainage. Early mining activity was concentrated in gulch and bench deposits on the upper reaches of the drainage, however, in modern times placer mining has exposed the buried interglacial deposits in the lower reaches of Highet Creek.

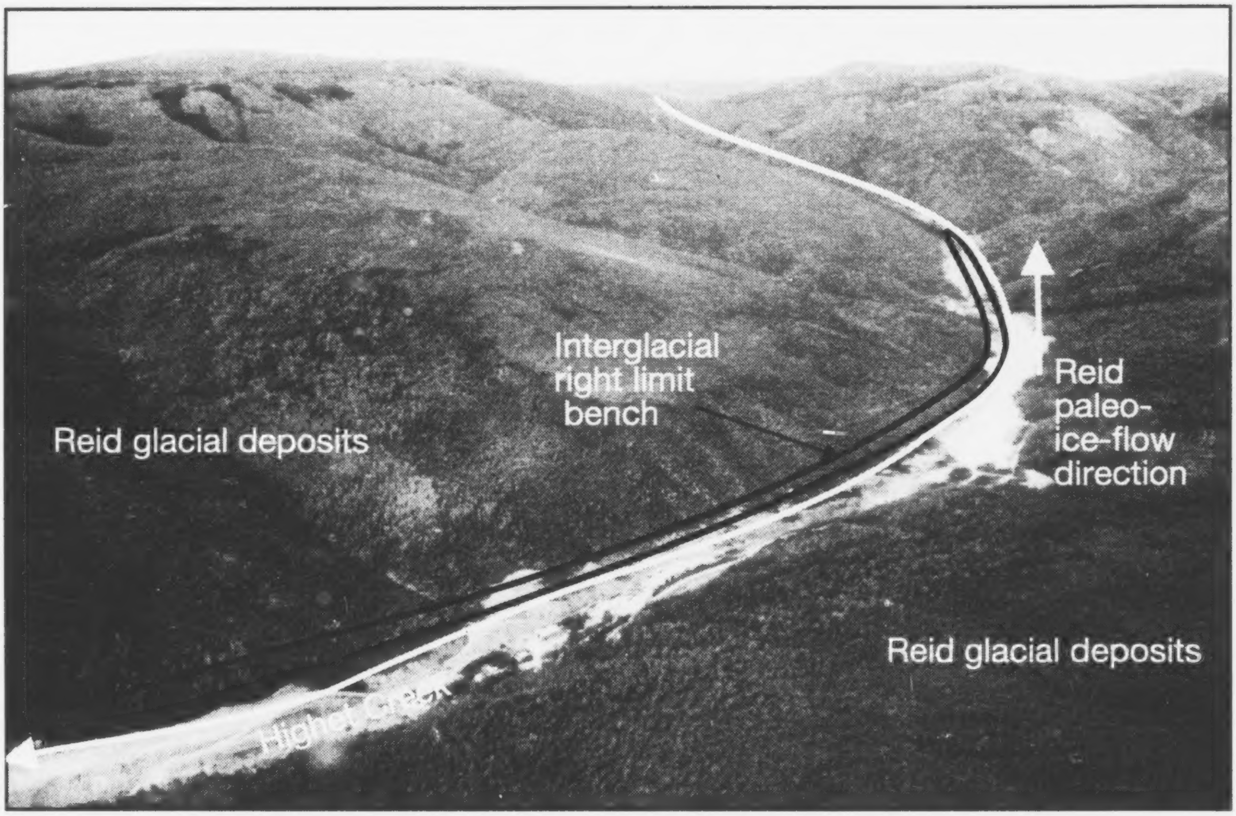


Figure 44. *Highet Creek looking upstream. Reid glacial ice flowed up the valley, blocking the drainage and preserving some interglacial placer deposits beneath glacial lake sediments. A pre-McConnell age interglacial right-limit bench was also preserved, which was the focus of historical placer mining.*

HAGGART CREEK/DUBLIN GULCH

Introduction

Coarse gold was first found on Haggart Creek in 1895, and significant mining activity began on Dublin Gulch in 1899. A number of operators mined there including Fred Taylor who acquired the ground in 1937. In 1971 the property was sold to Dublin Gulch Mining Ltd. (R. Holway and D. Duensing), who leased it to Canada Tungsten in 1978. An unknown quantity of tungsten (scheelite) and gold was recovered in subsequent years by Canada Tungsten. The property was returned to Dublin Gulch Mining in 1987. Mining since that time has concentrated mainly on the left and right limits of Haggart Creek, until 1998 when operations ceased. The total recorded placer gold production from 1895 to 1998 for Haggart Creek and Dublin Gulch is 77,751 crude ounces (2 418 300 g).

Location and access

Haggart Creek is one of the principal tributaries of the South McQuesten River and lies within the NTS map sheets 106D/4, 105M/13 and 115P/16 (Figs. 2 and 45). Haggart Creek drainage basin is located approximately 85 km north of Mayo; access to the area is by the Silver Trail highway and the South McQuesten road. Haggart Creek is over 33 km long and flows generally south-southwest into the South McQuesten River. Dublin Gulch is a left-limit tributary to Haggart Creek and lies within NTS map sheet 106D/4. Right-limit tributaries to Haggart Creek include Gill Gulch and Fisher Gulch, which also lie within NTS map sheet 106D/4.

Local geology

Within the Haggart Creek map area, moderately to highly strained sedimentary rocks are exposed in two northward-overlapping thrust sheets, known as the Robert

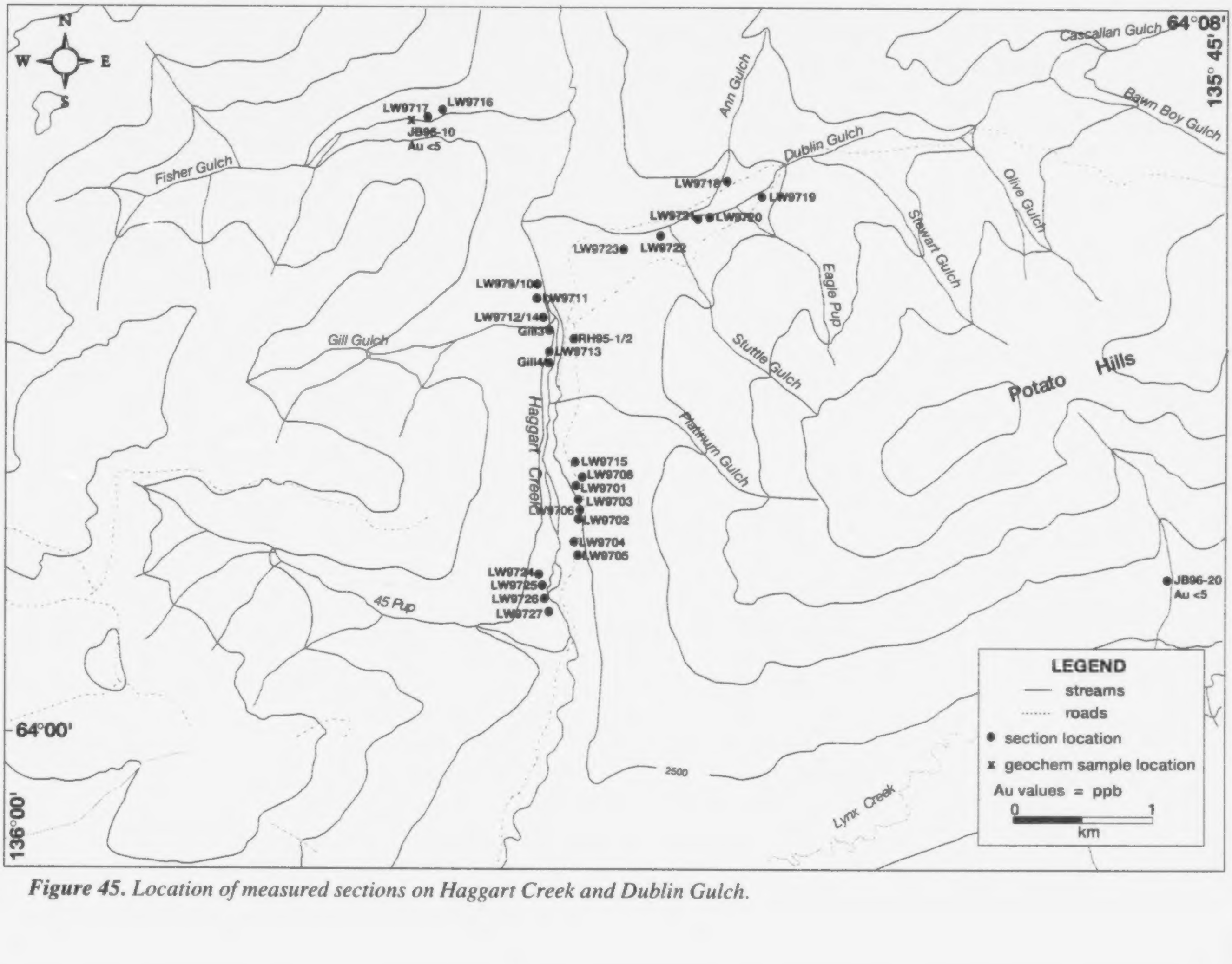


Figure 45. Location of measured sections on Haggart Creek and Dublin Gulch.

Service and the Tombstone thrust sheets (Fig. 4, Roots, 1997).

The Robert Service is the more southerly of the two thrust sheets. The oldest rocks exposed within the Robert Service Thrust Sheet are Late Proterozoic to Early Cambrian Hyland Group metasedimentary rocks (Roots, 1997). The Hyland Group is divided into two formations, the Yusezyu and the Narchilla. The older Yusezyu formation comprises predominantly phyllite, metasiltstone, medium- to coarse-grained metasandstone, metaconglomerate, and sandy marble, whereas the Narchilla formation includes quartzofeldspathic sandstone, maroon and green argillite, and grey, weathered marble (Green, 1971; Murphy and Héon, 1994). Overlying the Hyland Group rocks is a Cambrian to Middle Devonian succession, which includes the Gull Lake (green and dark brown siltstone), Rabbitkettle (thin, discontinuous white limestone), Duo Lakes (dark siltstone, argillite and chert) and Steel (green cherty argillite) formations. Together, the Hyland Group rocks and overlying formations form a component of the regional Selwyn Basin and are unconformably overlain by Upper Devonian Earn Group argillite, chert and chert-pebble conglomerate (Roots, 1997; Murphy and Héon, 1994).

The Tombstone Thrust Sheet lies to the northeast of the Robert Service Thrust Sheet. This sheet is comprised of highly strained Earn Group carbonaceous phyllite and metaconglomerate, overlain by Mississippian Keno Hill Quartzite (Roots, 1997; Green, 1971).

The Potato Hills stock outcrops above Haggart Creek, and consists of a medium-grained phaneritic granodiorite body dated at 92.8 ± 0.5 Ma (Smit et al., 1995). The stock has a width of up to 2 km and a length of 5.5 km and is elongated in the direction 70° (Smit et al., 1995). Developed around the stock, is a contact aureole of andalusite and biotite hornfels (Smit et al., 1995; Hitchins and Orssich, 1995). The Dublin Gulch deposit consists of gold-bearing sheeted veins and stockwork within the Potato Hills stock. Here an inferred and potential resource of 50.3 Mt at 0.93 g/t Au has been calculated (Brown et al., 2002). The Ray Gulch tungsten skarn deposit occurs on the eastern margin of the stock and contains drill-indicated and inferred reserves of 5.4 Mt at 0.82% WO_3 (Brown et al., 2002).

Other intrusive bodies occur west of Haggart Creek, however these bodies are much smaller in area and are only weakly mineralized. These bodies are predominantly dykes and sills of granodiorite to quartz monzonite composition; no quartz-gold veins were observed in any of the intrusions (Hitchins and Orssich, 1995). A more detailed account of the placer geology is given by Weston (1999).

Physiography

Haggart Creek lies in an area that is part of the Stewart Plateau, northeast of the Tintina Trench. It is proximal to the southern foothills of the Ogilvie Mountains. Elevations range from 2500 ft a.s.l. (760 m) in valley bottoms to approximately 5000 ft a.s.l. (1500 m) on local uplands. Haggart Dome, Lynx Dome, and Potato Hills are all broad rolling hills, which are above treeline (Figs. 2 and 45).

The major drainages in the area include Haggart Creek and Lynx Creek. Haggart Creek flows generally south-southwest into the South McQuesten River, while Lynx Creek flows southwest into Haggart Creek. Gill Gulch and Fisher Gulch are right limit tributaries to Haggart Creek while Dublin Gulch is an important left-limit tributary.

The lower reaches and the upper reaches of Haggart Creek are physiographically distinct. Lower Haggart Creek is morphologically an extension of the Lynx Creek valley and these creeks both occupy a very large, broad, u-shaped glacial valley. Upper Haggart Creek, having been less extensively glaciated, has a much narrower u-shaped glacial valley. Tributaries such as Dublin Gulch, Gill Gulch and Fisher Gulch are all transverse to the main regional ice flow and consequently these tributary valleys remain narrow and v-shaped with steep valley sides.

Surficial geology

The study area is characterized by colluvium-covered uplands, with minor exposed bedrock on plateau summits, ridges, and locally in gulches. A colluviated Reid till veneer was mapped between 2800 and 3600 ft (850-1100 m) on the left limit of Haggart Creek near the mouth of Lynx Creek (Bond, 1997b). Remnant Reid terraces are present at the confluence of Haggart and Lynx creeks and can be traced into upper Haggart Creek along the left limit. This terrace is exposed as a till blanket in a mining cut near the mouth of Dublin Gulch (measured section LW9722). The Reid terrace can be traced down the right limit of lower Haggart Creek to the mouth of Secret Creek. McConnell periglacial fans originate from all major tributaries in Haggart Creek. In Lynx Creek, periglacial fans coalesce to form an apron of sediment on the flanks of the valley. Colluvial aprons are present between the tributary fans in Haggart and Lynx creek valleys. Modern alluvium lines the floodplains of major streams.

Sedimentology

Introduction

Thirty-one sections were examined in detail in the Haggart Creek area between 1995 and 1997. Sections were located at active mining cuts, natural and road exposures and stream cutbanks. Figure 45 shows the location of the sections; these are summarized in Appendix 1d.

Dominant facies and interpreted environments of deposition

Haggart Creek and Dublin Gulch lie within the limit of the Reid glaciation but are outside of the limit of the McConnell glaciation. Landforms in the area include a remnant glaciofluvial terrace, alluvial fans and colluvial slope deposits. Several of the alluvial fans are dominated by sediments of Facies 11 (laminated and rippled sand, silt and mud - Flr) and Facies 1 (massive boulder-cobble diamict – Dmm). On bedrock along Haggart Creek, Facies 1 and Facies 2 (weakly stratified boulder-cobble diamict) are gold-bearing and are interpreted to be periglacial debris flows.

Stratigraphy

Representative stratigraphic sections

Figure 46 is a panel diagram demonstrating typical stratigraphy in the Haggart Creek area. Additional sections are located in Appendix 4.

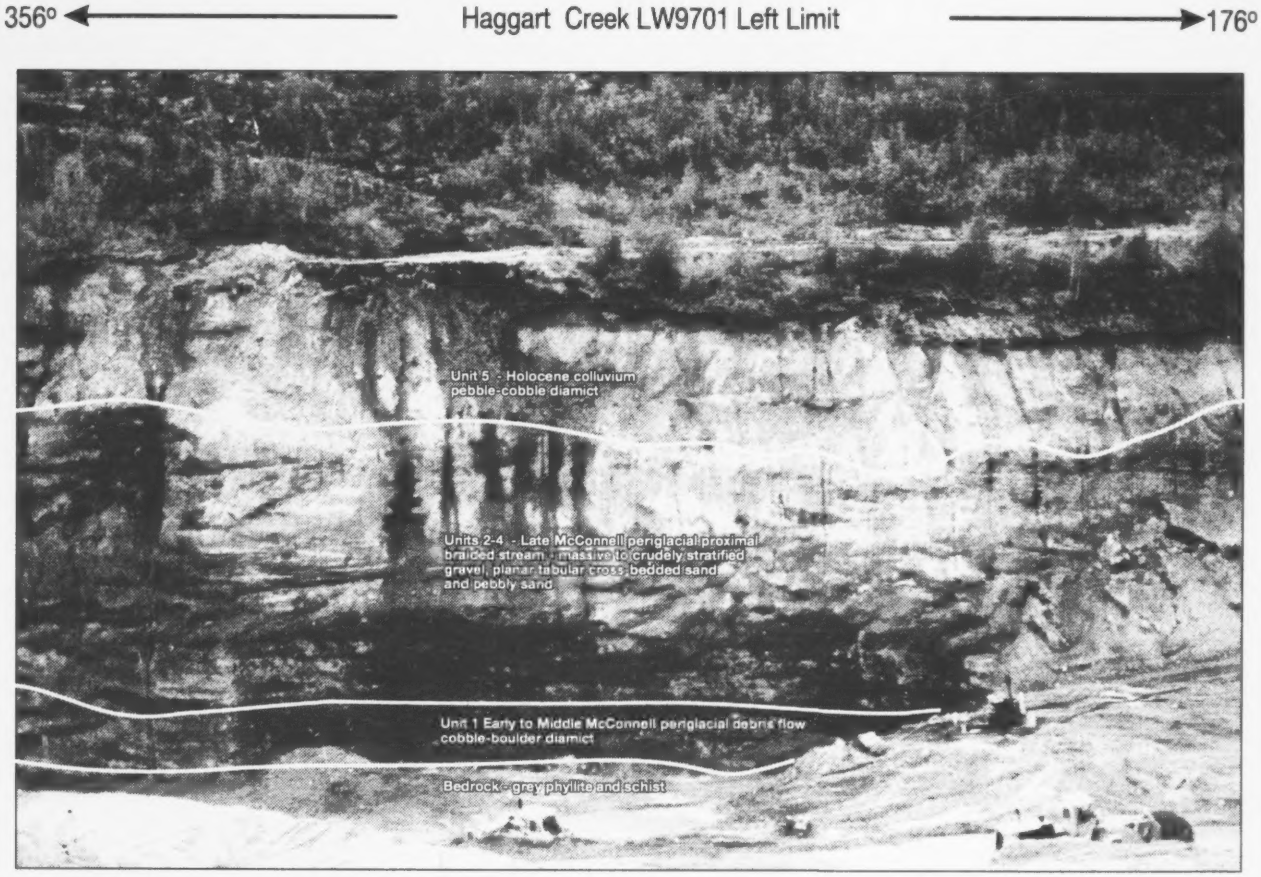

356°
Haggart Creek LW9701 Left Limit
176°
Unit 5 - Holocene colluvium pebble-cobble diamict
Units 2-4 - Late McConnell periglacial proximal braided stream - massive to crudely stratified gravel, planar tabular cross bedded sand and pebbly sand
Unit 1 Early to Middle McConnell periglacial debris flow cobble-boulder diamict
Bedrock - grey phyllite and schist

***Figure 46.** Measured section LW9701 illustrates typical stratigraphy on the left limit of Haggart Creek. Gravelly diamict of an early to middle McConnell periglacial debris flow is overlain by late McConnell periglacial proximal braided stream gravel and sand; and Holocene colluvium.*

Lithostratigraphic assemblages

Six lithostratigraphic assemblages are found in the Haggart Creek area; a representation of these is shown in Figure 47, which is a schematic cross-valley profile.

They are as follows:

- Assemblage 1 – Pre-Reid interglacial sediments
- Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments;
- Assemblage 3 – Late Reid glacial and periglacial sediments;
- Assemblage 5 – Early and Middle McConnell periglacial sediments;
- Assemblage 7 – Late McConnell periglacial sediments; and
- Assemblage 8 – Holocene alluvial sediments.

Stratigraphic relationships

Lithostratigraphic Assemblage 1 – Pre-Reid interglacial sediments

Assemblage 1 consists of pre-Reid interglacial fluvial, gulch and alluvial fan sediments that have been variably reworked and/or buried. In Dublin Gulch, a debris flow was found beneath Reid till on measured section LW9722. Reworked organic material from this unit was ^{14}C dated at >37 740 B.P. (Beta 111603, Table 9). This assemblage also occurred in Haggart Creek valley in measured section RH95-2.

Lithostratigraphic Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments

This assemblage was found on Dublin Gulch on measured section LW9722, where Reid till capped a pre-Reid debris flow. On Haggart Creek in measured section

Table 9. *Radiocarbon dates for pre-Reid sediments, Haggart Creek/Dublin Gulch area.*

Unit number	**Sample number**	**Location**	**^{14}C Date (type)**	**Comments**
LW97-22-U1	Beta-111603	Dublin Gulch	>37 740 (conventional)	organics @top of debris flow in contact w/till

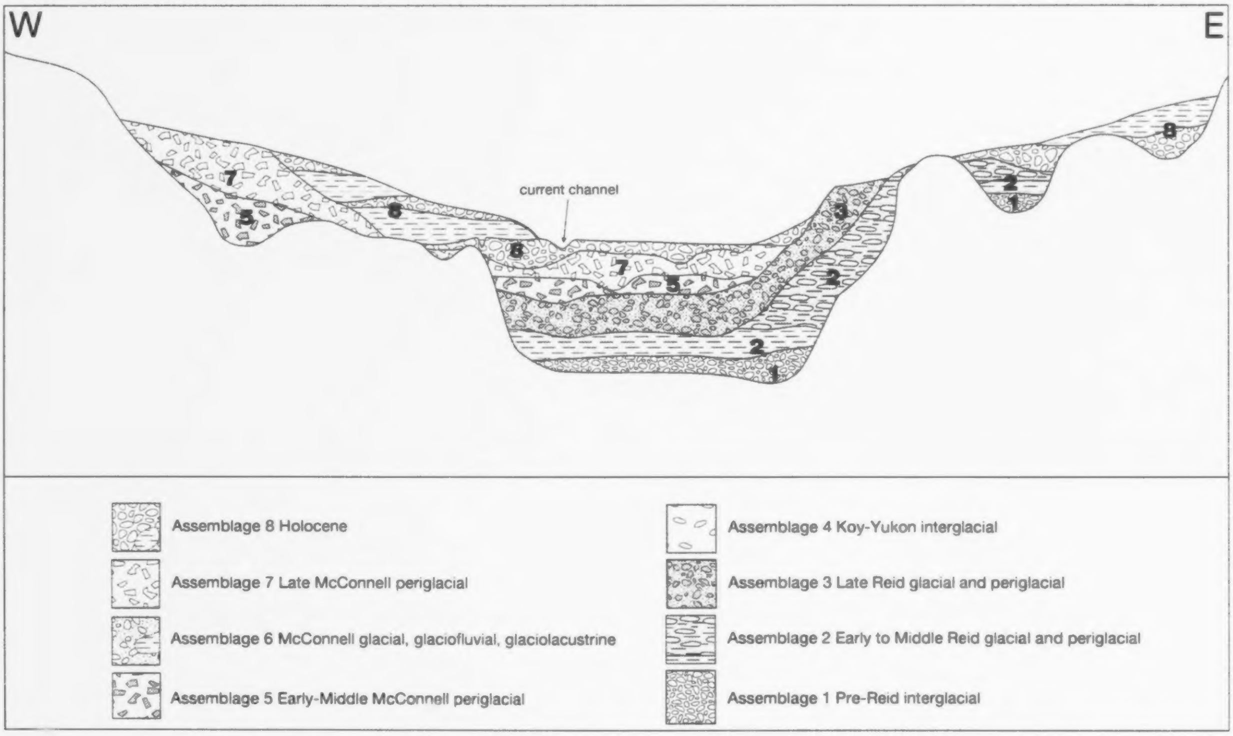

W
E
current channel
7
5
6
8
7
5
3
2
2
1
2
1
8
Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial and periglacial
Assemblage 1 Pre-Reid interglacial

Figure 47. *Schematic cross-valley profile of Haggart Creek and tributaries. Not to scale.*

Table 10. *Radiocarbon dates for Holocene sediments, Haggart Creek/Dublin Gulch area.*

Unit number	Sample number	Location	^{14}C Date (type)	Comments
LW97-05-07/1	Beta-109146	Haggart Creek	8170 ± 80 (conventional)	organics 50 cm from base
LW97-05-07/2	Beta-109147	Haggart Creek	7600 ± 80 (conventional)	organics 50 cm from top
LW97-08-05	Beta-109152	Haggart Creek	7970 ± 60 (conventional)	wood
LW97-26-U1	Beta-111605	Haggart Creek	6040 ± 70 (conventional)	80 cm from top of unit 1
LW97-18-U6	Beta-111602	Dublin Gulch	7430 ± 70 (conventional)	organic silt
LW97-09-02	Beta-109150	Gill Gulch	12310 ± 120 (conventional)	wood
LW97-13-U1	Beta-111604	Gill Gulch	8130 ± 80 (conventional)	organics at base of debris flow
LW9608-0	Beta-102618	Gill Gulch	8230 ± 60 (conventional)	Gill Gulch organics bag

RH95-2, Reid glaciolacustrine silts were observed overlain by diamict interpreted to be till.

Lithostratigraphic Assemblage 3 – Late Reid glaciofluvial, glacial and periglacial sediments

Reid till occurs as remnant terraces on both sides of Haggart Creek (Bond 1997b). It is likely that some of these terraces formed during the retreat (late) phase of the Reid glaciation, depositing glacial, glaciofluvial and periglacial sediments in the valley centre, which were later dissected and reworked by subsequent processes.

Lithostratigraphic Assemblage 5 – Early and Middle McConnell periglacial sediments

Assemblage 5 commonly contains reworked elements of Assemblage 4 (Koy-Yukon interglacial sediments) including organic material; and this is likely the case in Haggart Creek although such an occurrence was not observed in section during this study. Assemblage 5 occurs as periglacial fans on the valley side and as valley fill deposits along the main Haggart Creek valley.

Lithostratigraphic Assemblage 7 – Late McConnell periglacial sediments

McConnell age periglacial alluvial fan sediments were noted along Haggart Creek; these fans were probably deposited continuously throughout the McConnell glaciation, depositing sediments of Assemblage 7 on top of Assemblage 5.

Lithostratigraphic Assemblage 8 – Holocene alluvial, colluvial and eolian sediments

On the right limit of Haggart Creek below Dublin Gulch, Holocene alluvial gravels are found against the bedrock rim. At Gill Gulch, a low terrace of alluvial gravels (paleo-Haggart Creek) is covered by colluvium derived from reworked loess and organics. A sample of wood from this material was ^{14}C dated at 12 310 ± 320a B.P. (Beta 109150, Table 10), which represents the earliest post-McConnell date in central Yukon.

Paleogeographic history

The Reid glaciation was the last glacial episode that left significant surficial deposits in Haggart Creek. Lynx Creek valley acted as a conduit for ice spilling over from the South McQuesten River valley at its headwaters and at the headwaters above Skate Creek. Ice in Lynx Creek reached elevations of approximately 3700 ft (1100 m) and upon intersecting upper Haggart Creek valley spilled northwards against the local drainage. The glacier likely had little scouring energy in the valley because upper Haggart Creek was perpendicular to regional ice-flow. In addition, since the glacier was advancing uphill against the drainage, a glacial lake likely formed at the toe of the glacier, which provided a bed of lake sediment for the glacier to advance upon. This would have protected pre-existing placers from glacial scouring or reworking by meltwater. Reid ice glaciated the length of upper Haggart Creek valley and breached the pass into the East McQuesten River drainage (Fig. 48). In the vicinity of the pass, Haggart Creek ice would have merged with ice impinging up Christie Creek from the east McQuesten River valley. In contrast, Lynx Creek and lower Haggart Creek were aligned with the regional ice-flow patterns of the Reid glaciation. As a result, glacial flow was more rapid and erosion of the valley sides would have been significant. Reid ice also advanced up Swede Creek and breached the divide with Red Creek.

Placer geomorphology

The placer geology of upper Haggart Creek and Dublin Gulch reflects the process of late Pleistocene interglacial and glacial episodes. Following the Reid glaciation, upper Haggart Creek contained a significant amount of glacial fill, which covered pre-Reid interglacial placers (Fig. 49). The beginning of the post-Reid interglacial period (Koy-Yukon interglacial) marked a period of downcutting into the Reid sediments. The downcutting was extensive enough that it intersected the pre-Reid interglacial deposits and continued into bedrock.

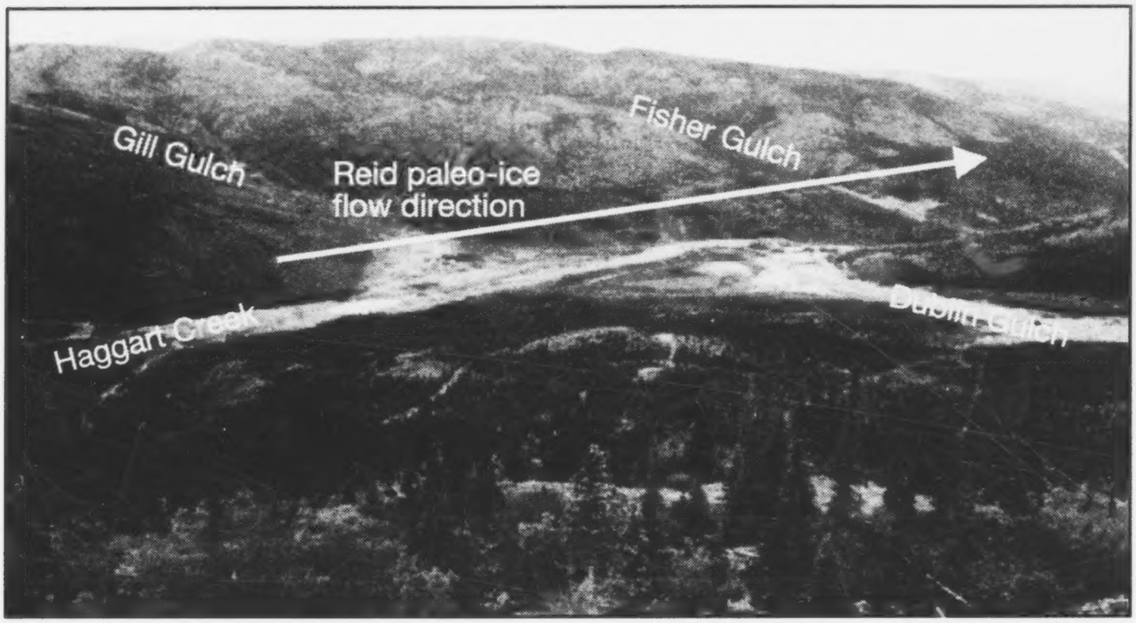


Figure 48. *View west towards Gill Gulch and Dublin Gulch at Haggart Creek. Reid ice moved though the valley from left to right, but was confined by the valley walls.*

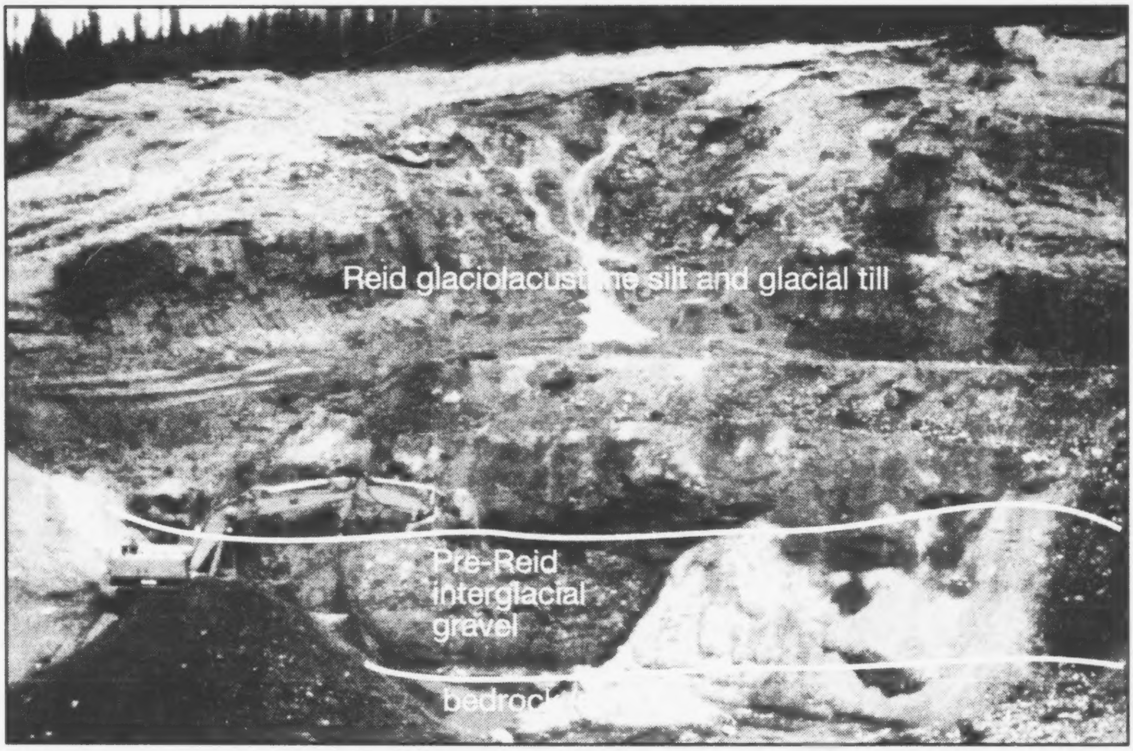

Reid glaciolacustrine silt and glacial till
Pre-Reid interglacial gravel
bedrock

Figure 49. *Placer mining in 1995 on the left limit of Haggart Creek exposed gold-bearing pre-Reid interglacial gravels beneath Reid glaciolacustrine silt and glacial till, in measured section RH95-2.*

Thus, pre-existing placers became part of the active stream channel during the last interglacial period. During the McConnell glaciation, a period of cold, harsh weathering conditions began, which initiated a period of periglacial fan sedimentation. Periglacial fans developed on the tributaries to upper Haggart Creek and subsequently buried the placer-gold bearing interglacial floodplain. By the end of the McConnell glaciation, periglacial fans covered a considerable amount of the floodplain in the valley. During the late McConnell and early Holocene, placer deposits formed on low terraces along Haggart Creek. Periglacial fan sedimentation on tributaries continued, which both controlled the course of Haggart Creek and buried previously-formed placer deposits. Early miners found the Holocene placers relatively accessible, but as mining progressed and these deposits were depleted, exploration focused on the placers buried along the margins of the valley. In recent years, most placers being mined on Haggart Creek have been early Holocene Haggart Creek deposits that were buried and preserved under Middle Holocene periglacial fans.

SOUTH MCQUESTEN/SEATTLE CREEK

Introduction

Seattle Creek and its tributary Morrison Creek have seen intermittent mining activity since the Discovery claim was staked in 1915. Gold production from both creeks combined is officially recorded as 224 crude ounces (6970 g), based on the limited data provided by Indian and Northern Affairs Canada Mining Recorder royalty records. Dan Klippert and family have mined on Seattle Creek since 1994 (Fig. 50).

Goodman and Rodin creeks have seen little mining activity since the Discovery claim was staked on Rodin Creek in 1908.

Location and access

The South McQuesten drainage basin is on NTS map sheet 115P/16 and includes the right limit tributaries of Goodman, Rodin and Haggart creeks, and the left limit tributaries Johnson, Castnor and Seattle creeks (Figs. 39

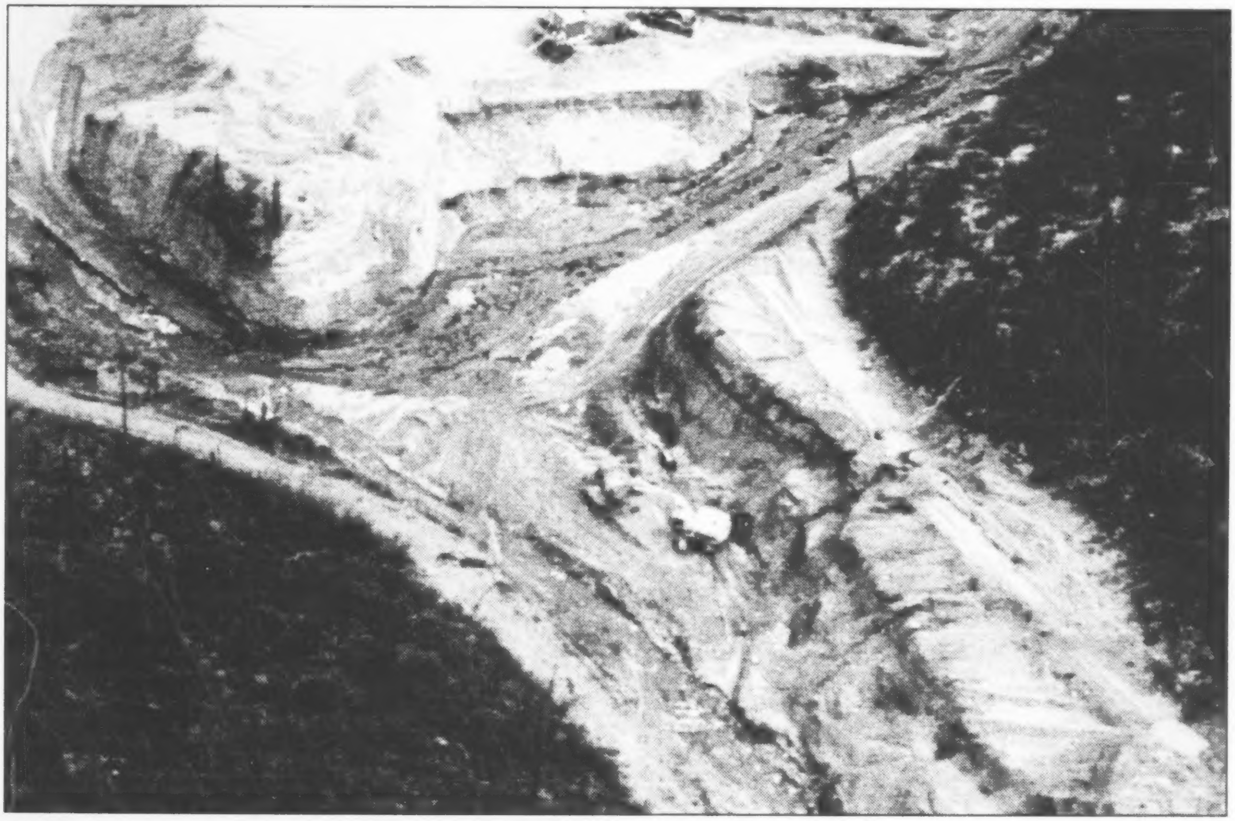


Figure 50. *Aerial view of Dan Klippert's mining operation on Seattle Creek in 1997. Gold-bearing gravel was found here beneath a McConnell-age periglacial fan.*

and 51). Access consists of a two-wheel drive summer road which branches from the Silver Trail Highway, 15 km north of the village of Mayo (Fig. 2). A network of four-wheel drive trails connects Johnson, Highet and Seattle creeks with some of their tributaries. Seattle Creek is connected to the South McQuesten road via a four-wheel drive road that branches off near Ross Creek.

Local geology

The Robert Service Thrust Fault crosses the map area at Seattle Creek, where it divides Upper Proterozoic to Lower Cambrian Hyland Group from Mississippian Keno Hill Quartzite and Devono-Mississippian Earn Group (Murphy, 1997). Cretaceous hornblende granodiorite intrudes Hyland Group phyllite on the uplands between Highet Creek and Seattle Creek (Murphy, 1997). The faulted McQuesten Antiform trends northeast through the map area mainly following the valley of the South McQuesten River.

Several mineral deposits are located in the area including the Jaybee and Seattle lead-zinc silver veins (Yukon MINFILE, 1997, 115P 001, 115P 002), the Hawthorne and Bennett gold-stibnite veins (Yukon MINFILE, 1997, 115P 003, 115P 033) and the Scheelite Dome stock, which hosts a gold-tungsten skarn deposit (Yukon MINFILE, 1997, 115P 004).

Physiography

The South McQuesten map area consists of a large incised plateau bounded by broad, u-shaped, glaciated valleys, including the South McQuesten River, which flows from northeast to southwest through the centre of the map area, and the North McQuesten River which joins the South McQuesten River from the north. The Secret/Red creek drainage is an intermediate scale east-trending valley that runs across the north half of the map area (Fig. 2). Uplands north of the South McQuesten River average 3900 ft (1200 m) a.s.l., while uplands south of the South McQuesten River reach 5240 ft (1600 m) a.s.l. The Scheelite Uplands are drained by the deeply-incised valleys of Johnson, Seattle and Castnor creeks to the north and Highet and Bennett creeks to the south.

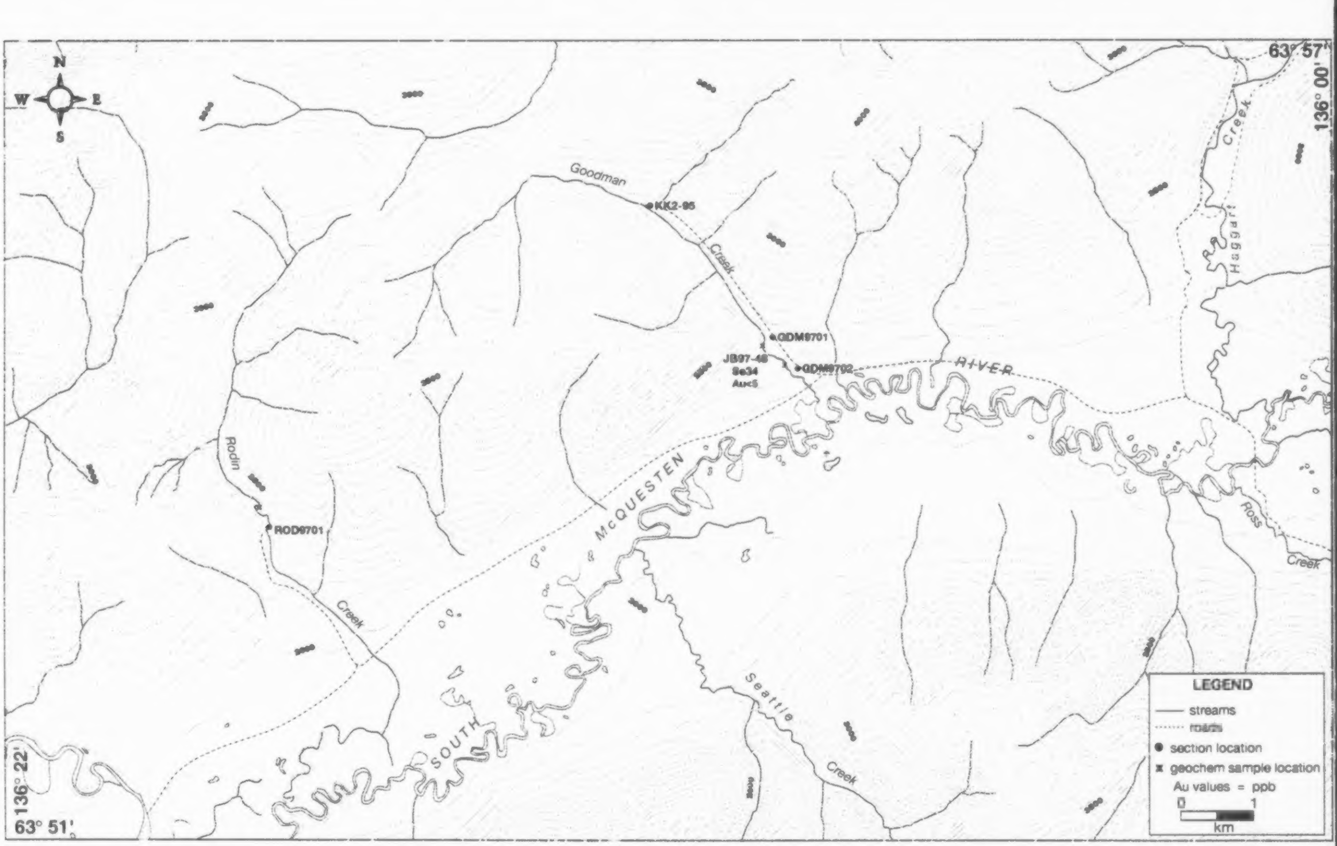


Figure 51. Location of measured sections on Goodman and Rodin creeks.

Surficial geology

McConnell and Reid Cordilleran glacial deposits and South McQuesten River alluvial deposits dominate the surficial geology of the South McQuesten River area. McConnell till flanks the lower slopes of Mt. Haldane and the south-facing slope of an unnamed ridge separating Haggart Creek from the South McQuesten River valley. This ridge is informally termed Snowshoe ridge. The limit of McConnell till rises from the valley bottom to 3300 ft (1000 m) onto Snowshoe Ridge east of Shanghai Creek (Bond 1998b). The South McQuesten River valley bottom consists of McConnell glaciofluvial plains and terraces with alluvial deposits in the modern floodplain.

Outside the McConnell limit, the plateau slopes and summits are draped with a veneer of colluviated Reid till. A Reid till blanket is present near the confluence of Haggart Creek valley with the South McQuesten River valley. Aeolian deposits were mapped on the Rodin Creek alluvial fan in South McQuesten River valley. The sand is derived from thick Reid glacio-deltaic deposits in Rodin Creek that have been redeposited into the alluvial fan during the last interglacial and modern interglacial. The dunes may have developed from katabatic winds originating from the McConnell ice sheet.

Sedimentology

Introduction

Ten sections were examined in detail in the South McQuesten drainage between 1995 and 1997. Sections were located at active mining cuts and stream cutbanks. Figures 39 and 51 show the location of the sections; these are summarized in Appendix 1e.

Dominant facies and interpreted environments of deposition

Seattle, Rodin and Goodman creeks are outside of the McConnell glacial limits but within the limits of the Reid glaciation. Dominant landforms in this area are periglacial alluvial fans, which formed during the McConnell glaciation. These alluvial fans include sediments of Facies 1 (massive boulder-cobble diamict – Dmm), Facies 3 (weakly stratified/imbricated boulder gravel – Gms), Facies 5 (stratified/cross-stratified gravel - Ghpt), Facies 6 (massive to stratified pebbly fine sand – Sh), Facies 7 (planar tabular cross-bedded pebbly fine sand – Sp), and Facies 9 (ripple cross-bedded sand – Sr). A McConnell-age braided outwash plain along the south McQuesten River is dominated by Facies 3 (weakly stratified/imbricated boulder gravel – Gms).

Stratigraphy

Representative stratigraphic sections

Figure 52 is a panel diagram demonstrating typical stratigraphy in the South McQuesten/Seattle Creek area. Additional sections are located in Appendix 4.

Lithostratigraphic assemblages

Six lithostratigraphic assemblages are found in the South McQuesten/Seattle Creek area; a representation of these is shown in Figure 53, which is a schematic cross-valley profile.

They are as follows:

- Assemblage 1 – Pre-Reid interglacial sediments
- Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments;
- Assemblage 3 – Late Reid glacial and periglacial sediments;
- Assemblage 5 – Early and Middle McConnell periglacial sediments;
- Assemblage 7 – Late McConnell periglacial sediments; and
- Assemblage 8 – Holocene alluvial sediments.

Stratigraphic relationships

Lithostratigraphic Assemblage 1 – Pre-Reid interglacial sediments

Assemblage 1 consists of pre-Reid interglacial fluvial, gulch and alluvial fan sediments that have been variably reworked and/or buried. On Seattle Creek, a rusty alluvial gravel, likely of pre-Reid age, underlies the Reid glaciofluvial gravel. This unit has scattered placer gold values within it although it was not found to be economic at that locality.

Lithostratigraphic Assemblage 2 – Early and Middle Reid glaciofluvial, glacial and periglacial sediments

This assemblage occurs as isolated deposits of glaciofluvial gravel including eskers and kame terraces on ridges above 2500 ft (760 m). Remnants of this assemblage also likely occur on the bedrock floor of many of the tributaries to the South McQuesten River.

Lithostratigraphic Assemblage 3 – Late Reid glaciofluvial, glacial and periglacial sediments

Remnant terraces of Reid till occur on several tributary drainages of the South McQuesten, including Seattle Creek. In addition, a boulder-rich glaciofluvial gravel lies beneath McConnell periglacial fan sediments of Assemblage 5 on Seattle Creek and Goodman Creek. Placer gold within this assemblage is likely a result of this glaciofluvial outwash reworking pre-Reid interglacial alluvial gravel of Assemblage 1 from upstream.

Lithostratigraphic Assemblage 5 – Early and Middle McConnell periglacial sediments

Assemblage 5 occurs as periglacial fans on the sides of Seattle, Goodman and Rodin creeks. As Assemblage 5 is the initial stage of fan development, it commonly contains reworked elements of Assemblage 4 (Koy-Yukon interglacial sediments). This may account

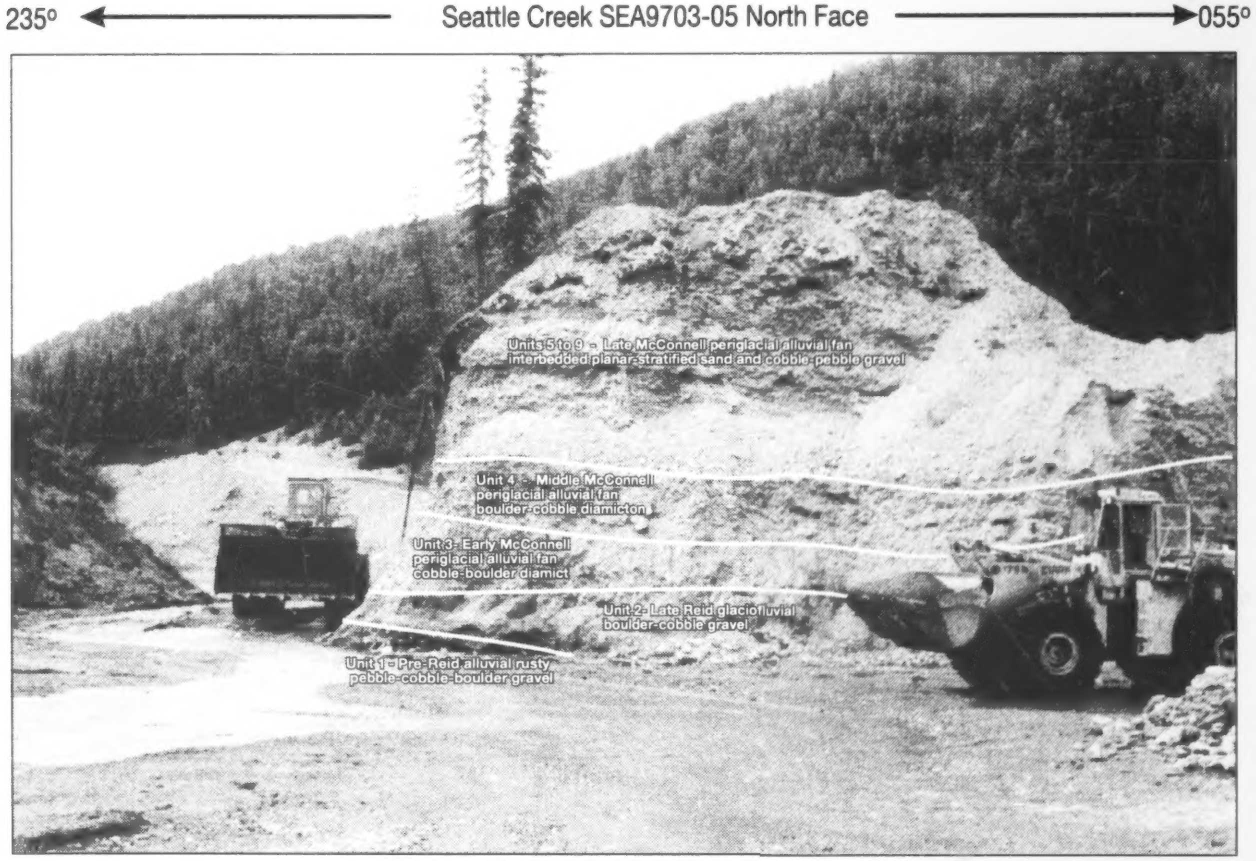

235°
Seattle Creek SEA9703-05 North Face
055°
Units 5 to 9 - Late McConnell periglacial alluvial fan interbedded planar-stratified sand and cobble-pebble gravel
Unit 4 - Middle McConnell periglacial alluvial fan boulder-cobble diamicton
Unit 3- Early McConnell periglacial alluvial fan cobble-boulder diamict
Unit 2- Late Reid glaciofluvial boulder-cobble gravel
Unit 1 - Pre-Reid alluvial rusty pebble-cobble-boulder gravel

Figure 52. *Panel diagram illustrating typical stratigraphy on Seattle Creek, with McConnell periglacial fan sediments overlying Reid glaciofluvial gravel and pre-Reid alluvial gravel. Placer gold is found mainly in the early McConnell periglacial gravelly diamict, although some gold occurs in the Reid glaciofluvial gravel and the pre-Reid alluvial gravel.*

for the occurrence of placer gold within it, especially on Seattle Creek.

Lithostratigraphic Assemblage 7 – Late McConnell periglacial sediments

Outside of the McConnell glacial limit, McConnell age periglacial alluvial fan sediments were deposited continuously throughout the South McQuesten drainage, depositing sediments of Assemblage 7 on top of Assemblage 5. In Rodin Creek, periglacial processes reworked Reid-age glaciofluvial sediments from a Reid delta into a McConnell periglacial fan. Ice-cast sand wedges are common throughout this assemblage (Fig. 54).

Lithostratigraphic Assemblage 8 – Holocene alluvial, colluvial and eolian sediments

Holocene alluvial gravel occurs in all of the South McQuesten tributaries in addition to the main valleys. In Rodin Creek, these gravel deposits contain placer gold where they overlie periglacial sand deposits, which act as a "false bedrock."

Paleogeographic history

The South McQuesten River valley acted as a conduit for Cordilleran ice flowing south from the Ogilvie and Wernecke Mountains during both the Reid and McConnell glaciations. Most of the ice glaciating the South McQuesten River valley originated from the drainages of the Beaver and Rackla rivers and flowed into the South McQuesten River valley via McQuesten Lakes valley and the Keno-Ladue River valley.

During the Reid glaciation, ice overtopped many of the plateaus bordering the South McQuesten River. Scheelite Dome and Mount Haldane were the largest nunataks in the vicinity of the South McQuesten River. Reid ice reached 4500 ft (1400 m) on Mount Haldane and 4300 ft (1300 m) on Scheelite Dome. Most tributary valleys to the South McQuesten River were infilled with Reid ice, which merged with the North McQuesten ice lobe

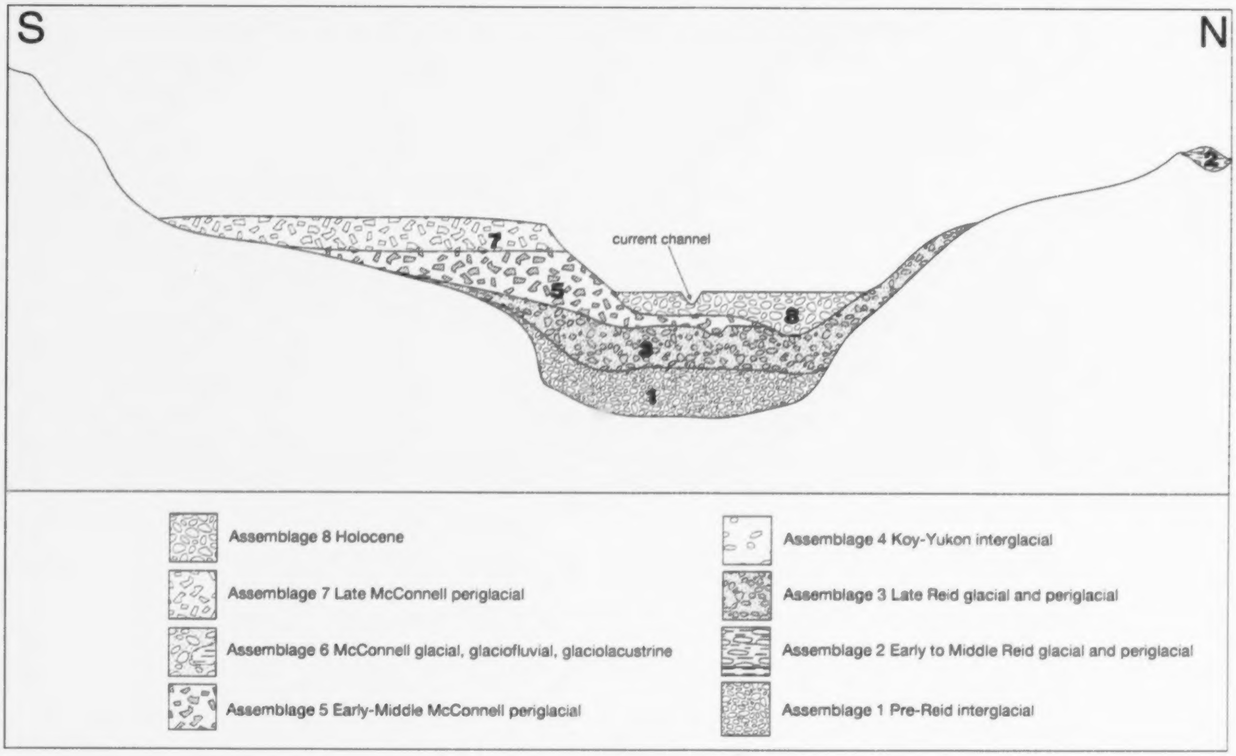

S
N
current channel
7
5
8
3
1
2
Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial and periglacial
Assemblage 1 Pre-Reid interglacial

Figure 53. *Schematic cross-valley profile of Seattle Creek showing relations between lithostratigraphic assemblages. Not to scale.*

and advanced to its terminus at the Tintina Trench (Bond, 1997b).

The McConnell glaciation terminated north of Mount Haldane in the South McQuesten River valley and, like elsewhere in central Yukon, was less extensive than the Reid glaciation. Broad McConnell glaciofluvial terraces are preserved along the margins of the South McQuesten River valley from McQuesten Lake to the North McQuesten River confluence. McConnell katabatic winds eroded and deposited a veneer of loess across much of the valley bottom landforms.

Placer geomorphology

Few placer occurrences have been documented in the South McQuesten River area, aside from those in Haggart Creek drainage. Placers have been reported in Seattle, Rodin, and Goodman creeks. Johnson Creek also has placer gold and flows into the McQuesten River just downstream from the confluence of the North and South McQuesten Rivers. Recent activity in Seattle Creek has focused in the upper parts of the drainage basin near the confluence of a tributary stream with Seattle Creek. This tributary is informally named Klippert Gulch. Gold placers have been mined beneath a McConnell periglacial fan from Klippert Gulch. Two distinct deposits have reported production near the base of the fan. The lower deposit is a coarse Reid glaciofluvial outwash that has a flow direction down Seattle Creek. The second deposit lies above the outwash and is considered to be a debris flow deposit originating from Klippert Gulch. Underlying these gold-bearing units is rusty alluvial gravel of pre-Reid age. The origin of placer gold in the outwash deposit is likely a result of outwash reworking upstream pre-Reid alluvial gravel. Placer gold in Klippert gulch likely consists of interglacial gold that was reworked by periglacial processes during the McConnell glaciation.

The gold-bearing unit on Goodman creek consists of coarse boulder-cobble gravel that is probably Reid glaciofluvial outwash. In a placer setting nearly identical to that of Seattle Creek, this placer deposit is buried by a McConnell age periglacial fan.

On Rodin Creek, gold-bearing gravel is exposed above bedrock within a thick stratified sand succession, which is interpreted as a variably reworked Reid glaciofluvial delta. This auriferous cobble-boulder gravel probably reconcentrated placer gold within channels that eroded weathered bedrock or paleoplacer sources upstream. Reworked deltaic sands and silts acted as resistant false bedrock, which allowed placer gold to concentrate along the gravel/sand contact.

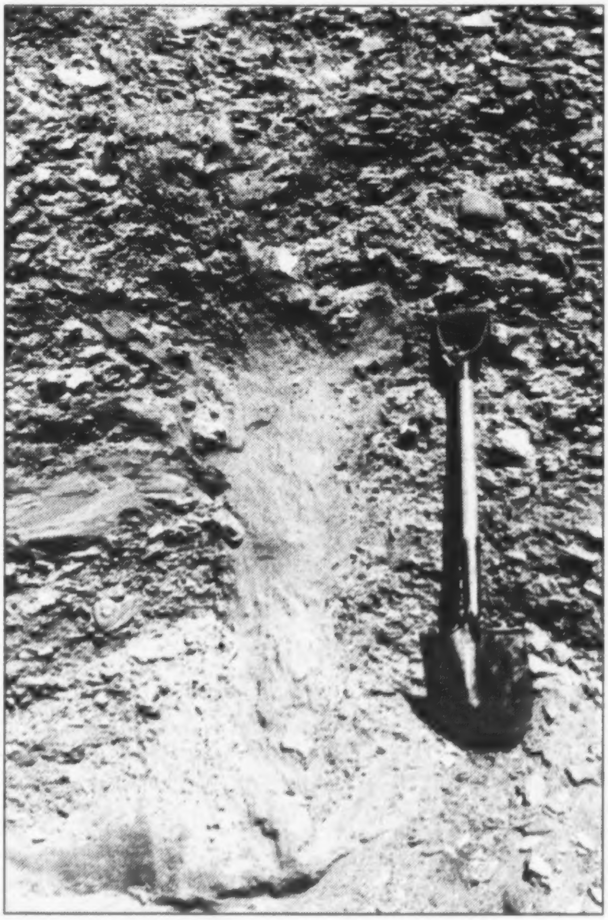


Figure 54. *Ice-cast sand wedges are well developed in McConnell-age periglacial sediments on Seattle Creek.*

REGIONAL INVESTIGATIONS – EXPANDING THE BORDERS

GUSTAVUS RANGE

The Gustavus Range is located immediately south and east of Keno City. Placer deposits, mentioned earlier in this report, have been mined from Thunder, Lightning and Upper Duncan creeks. All these drainages originate in the Gustavus Range. Numerous other drainages originate in this highland and bear placer potential based on the pre-existing producers and widespread similar geology. These streams include Keystone, Granite, Glacier, McNeill, McMillan, Allen and McKim creeks.

The Gustavus Range consists of Late Proterozoic to Early Cambrian Hyland Group phyllite, psammite and rare calcsilicate rock in the southwest and Devono-Mississippian Earn Group, Mississippian Keno Hill Quartzite and Triassic sills in the northeast (Murphy and Roots, 1996). Gold mineralization in the Gustavus Range occurs within vein-faults that were filled by hydrothermal fluids in the Keno Hill Quartzite and Triassic metadiorite sills. The origin of the fluids is thought to be connected with either the Roop Lakes pluton to the east, or from a more local unidentified intrusive source that underlies the range proper (Murphy, 1997; D. Ouellette, pers. comm., 2002). The timing of fluid emplacement for the argentiferous fluids and the auriferous fluids is uncertain and it is possible they represent separate hydrothermal events that occupied similar structural gaps in the host rocks (D. Ouellette, pers. comm., 2002). The gold potential of the Hyland Group appears less prospective relative to the younger Triassic and Mississippian rocks in the Gustavus Range. However, there is nearby placer gold production from streams draining Hyland Group rocks along Mayo Lake.

The glacial history is one of the controlling factors for placer development in the Gustavus Range. The alpine glacial history is variable in the range, and depends on the orientation and elevation of cirques. Drainages with north-, northeast- and east-facing cirque headwalls have had more ice accumulation in the past than drainages with west- and south-facing headwalls. This history plays a large role in the drainage geomorphology and placer development. The main producing creeks from the Gustavus Range are Thunder Gulch, including Lightning Creek below Thunder Gulch, and upper Duncan Creek, which are both west-facing drainages that had limited to no ice accumulation during the McConnell glaciation. Thunder Gulch, in particular, was not glaciated during the McConnell and has a relatively incised drainage morphology that is conducive to placer concentration. Upper Duncan Creek had small alpine glaciers develop at its headwaters during the McConnell glaciation. While the hydrology of the stream would have fluctuated during the glaciation, there is a long unglaciated reach in this drainage for heavy minerals to concentrate.

Keystone Creek

The only other drainage in the Gustavus Range that has had limited alpine ice accumulation is Keystone Creek. No placer production is reported from the stream, however the bedrock geology in the drainage is similar to Upper Duncan Creek. McConnell meltwater spilled down the drainage from the divide with Granite Creek, where McConnell ice terminated. Also, ice in Mayo Lake valley flowed into Keystone Creek, advancing a short distance up the drainage (see Bond, 1998d, in pocket). The effect of the Mayo Lake ice was probably non-erosive, but would have deposited glacial sediment in the drainage. This would have included glacial lake silt and clay. The effect of the meltwater spilling over the Granite Creek divide may have remobilized placers higher in the drainage and redeposited them at a higher stratigraphic level downstream. The extent of this reworking is unknown. A kame terrace was sampled at the mouth of Keystone Creek on the right limit. Sediment in the kame is likely of Keystone origin but may have a large outwash component from the Granite Creek spillway. Heavy mineral analyses from the kame returned 16 gold grains, abundant magnetite and a topaz crystal. Overall the heavy mineral assemblage was anomalous (see Heavy Mineral Studies). Keystone Creek has also undergone base level changes following the drop in the Mayo lake shoreline during deglaciation. This erosional event is considered beneficial in reducing the depth to bedrock in the drainage. Incised fan-delta remnants are visible near the apex of the modern fan-delta and provide evidence of the former lake level (Fig. 31). The stream sediment geochemistry of Keystone Creek and its tributaries contained only background levels of gold (<5 ppb) with the exception of the lower right-limit tributary, which contained 10 ppb gold.

McNeill Gulch, McMillan Gulch, Granite Creek and Glacier Creek

McNeill Gulch, McMillan Gulch, Granite Creek and Glacier Creek all have a similar drainage morphology and prospective geology. During the last glaciation alpine ice accumulated in each of the four drainages and advanced 3-5 km. Well-developed end moraines are documented at the mouth of each cirque (Fig. 9; Bond, 1998d, in pocket). The intensive ice-flow within these drainages would have scoured the former streambeds and reworked alluvium into the end moraines. Pockets of paleo-alluvium may still exist in the glaciated valleys where lithologic or structural contacts provide topographic traps. Paleochannels may also be buried under the end moraines. The thick moraine accumulations will hinder the economics of these placer settings. Previous placer exploration on McNeill Gulch has focused where the stream cuts through and concentrates the low-grade placer-bearing end moraine sediment. This placer setting probably provides the most viable opportunity in these drainages, with the exception of McMillan Gulch, where the stream has not eroded a significant portion of the end moraine. The gold geochemistry measured in stream sediments at McNeill Gulch was 65 ppb. This is considered an anomalous value from the Mayo area dataset.

Lower Granite Creek

Lower Granite Creek differs from the upper alpine glaciated portion. The lower reach of Granite Creek flows east into the Roop Lakes and was glaciated by McConnell Cordilleran ice flowing up-valley. The stream is incised into the glacial fill and in places into bedrock where it traverses the Roop Lakes stock. The glacial fill is likely significantly thick near the terminus of the McConnell ice. There may be more potential further down the valley where the stream becomes incised into bedrock. Cut-in-bedrock benches were noted along the lower section of the stream, which would provide a good means of prospecting the stream. The stream geochemical value for gold in Granite Creek near the alpine end moraine was 20 ppb. The north-flowing tributary opposite upper Granite Creek contained 25 ppb gold in stream sediments. This geochemistry, while not anomalous, suggests the prospective geology continues into this part of the Gustavus Range.

Allen Creek

Allen Creek drains north out of the Gustavus Range into the Keno-Ladue River. The geology of Allen Creek is similar to surrounding drainages and is considered prospective for gold placers. The glacial history is also similar, however the ice did not advance down the full length of the drainage during the last glaciation. As a result, pre-existing placers would have been reworked in the upper part of the drainage and probably deposited into the lower reaches. This is a similar glacial history as Upper Duncan Creek but with more extensive alpine ice accumulations. Economic placer deposits in Allen Creek may be restricted to pocket accumulations, such as at the confluence with Faith Creek. Cordilleran ice glaciated the lower part of the drainage, however ice flow was transverse to the drainage and deposition was likely dominant. Gold values in the stream sediments were below detection limits in this drainage.

McKim Creek

McKim Creek flows northeast off the Gustavus Range into the Keno-Ladue River. McKim Creek has a similar geologic setting as Allen Creek but is more proximal to the Roop Lakes stock. According to Green (1971) a portion of the Roop Lakes stock enters into the drainage. This may provide an intrusive-hosted gold source for McKim Creek. Approximately 80 % granitic cobbles and boulders were noted in McKim Creek at the stream sediment sampling station. Alpine ice accumulated in the upper part of the drainage, however most of the drainage was glaciated by the McConnell Cordilleran valley glacier flowing west-northwest in the Keno-Ladue River valley. Distinct lateral moraines are visible in the basin and actually impounded ice marginal drainage into small glacial lakes. The middle reaches of McKim Creek are not well incised. The lower 6 km of the drainage would be considered more prospective where it becomes entrenched into glacial fill and bedrock. The stream sediment geochemistry of McKim Creek returned a value of <5 ppb Au.

WEST MAYO AREA

The west Mayo area includes water courses such as Sprague Creek, North McQuesten River and upper Little South Klondike River and tributaries north of the McQuesten River. Although placer gold has been mined from several streams within the area including Gem Creek, Arizona Creek and Hobo Creek, there are currently no active placer mines. The following bedrock geological summary is adapted from Murphy (1997). The area is underlain by deformed low-grade Upper Proterozoic to mid-Paleozoic metasedimentary rocks and two suites of Cretaceous felsic intrusions. The intrusive suites include the horneblende-bearing Tombstone Suite

(91-93 Ma) and the muscovite-bearing McQuesten Suite (64 and 66 Ma). Mineralization occurs in veins, breccias and as disseminated mineralization associated directly with the intrusion, and peripherally in the surrounding metasedimentary rocks. The Tombstone Suite is considered more prospective for gold mineralization, whereas the McQuesten Suite has silver, tin and base metal potential. Breccias associated with north-northwest-trending structural lineaments are also anomalous in gold.

The area lies beyond the limit of the Cordilleran McConnell glaciation, straddles the Reid limit, and was more regionally glaciated during pre-Reid glaciations. Evidence of Reid ice entering the map sheet is confined to lower Sprague Creek valley and the McQuesten River valley where till and outwash terraces are preserved along the valley sides (Bond, 1998a,b and e, in pocket). Evidence of pre-Reid glaciations was noted from drainage anomalies in Sprague Creek valley and interfluve meltwater channels incised between drainage courses. Locally, alpine ice accumulations were abundant during Reid and pre-Reid glaciations on West Ridge, East Ridge and Red Mountain. During the McConnell glaciation a small alpine glacier developed on the north slope of Mt. Bostock at the south-end of East Ridge and four alpine glaciers developed on West Ridge (Bond, 1998a, 1999, in pocket).

The effect of glaciations on the map area is most notable in the drainage physiography. Tributaries to the McQuesten River are far more incised than tributaries of the Klondike River due to the more recent glacial history of the McQuesten River valley. McQuesten River valley was a conduit for glaciers, which resulted in increased erosion of the valley. Although the Klondike River valley was a conduit for valley glaciers, it is more distal to those Little South Klondike River tributaries and therefore had less capability to influence base-level changes in the area. A comparison of the cross-valley profiles of two similar drainages, on either side of the regional divide, shows the contrast in the physiography within the west Mayo area (Fig. 55).

The morphologic differences of the drainage basins within the area have likely impacted the potential placer settings. The drop in base-level for the McQuesten River tributaries is evident by the v-shaped morphology outlined in the cross-valley profiles. This morphology also indicates a large volume of erosion has taken place, which is a favourable history for the development of placer deposits. The large drop in base level would have reworked possible pre-existing placers into new settings, such as pocket concentrations. A similar situation was documented from stratigraphic records on Highet Creek following the Reid glaciation. Potential placer deposits will likely lie on bedrock, and possibly at higher stratigraphic horizons on false bedrock surfaces that contain placers from partial incision events. Depth to bedrock in the tributaries to the McQuesten River will vary within the individual drainage basins as well as between drainage basins. Typically, depth to bedrock will increase along the lower reaches of a drainage basin. Possible minor variations due to Holocene base-level changes may occur near the mouth of a stream or at cascades within a water course that result from resistant bedrock lithologies.

Base-level reductions have been less dramatic for the Klondike River tributaries. In addition, no continental glaciers have impacted the landscape for at least 300 000 years. It is suspected that potential placer deposits will occur within relatively shallow ground in this terrain. This may not be true for streams such as Josephine Creek, which drain West Ridge and have been glaciated in their upper reaches during the McConnell and Reid glaciation. Because base-level changes have been less dramatic with a correspondingly smaller amount of bedrock erosion, viable placer deposits may require higher initial bedrock gold concentrations as compared to McQuesten River tributaries.

McQuestion River tributaries

The McQuesten River has numerous south-draining tributaries from the divide with the Little South Klondike River. These include Forty Mile, May, Boulder and Sunshine creeks. The regional stream geochemistry data (RGS) indicates values above the 90th percentile in Forty Mile Creek, May Creek and Boulder Creek. A stream sediment geochemical project from this study sampled Forty Mile Creek and verified anomalous gold in that drainage. A sample taken from the upper left fork tributary returned a value of 520 ppb Au. This is the highest value from the entire Mayo survey area. A value of 15 ppb Au was obtained in a sample from the upper right fork tributary. Bedrock in the Forty Mile drainage consists of Yusezyu Formation phyllites, psammite and marble (Murphy and Héon, 1996). The gold may have originated in association with black cassiterite that occurs within the Tombstone Strain Zone (Murphy, 1997). Stream sediment geochemical anomalies in May and Boulder creeks are likely related to the Bos stock Tombstone intrusion lying between the two drainages. The placer potential of these creeks is favourable, however economic values may be restricted to pockets such as near tributary junctions. The mineability of Boulder Creek will be restricted by the presence of abundant granite boulders in the stream-bed from the Boulder Creek stock.

Little South Klondike River tributaries

Tributaries with placer exploration history in the Little Klondike River drainage basin include Josephine, Big, Hobo, Arizona, Sprague and Gem creeks. Placer

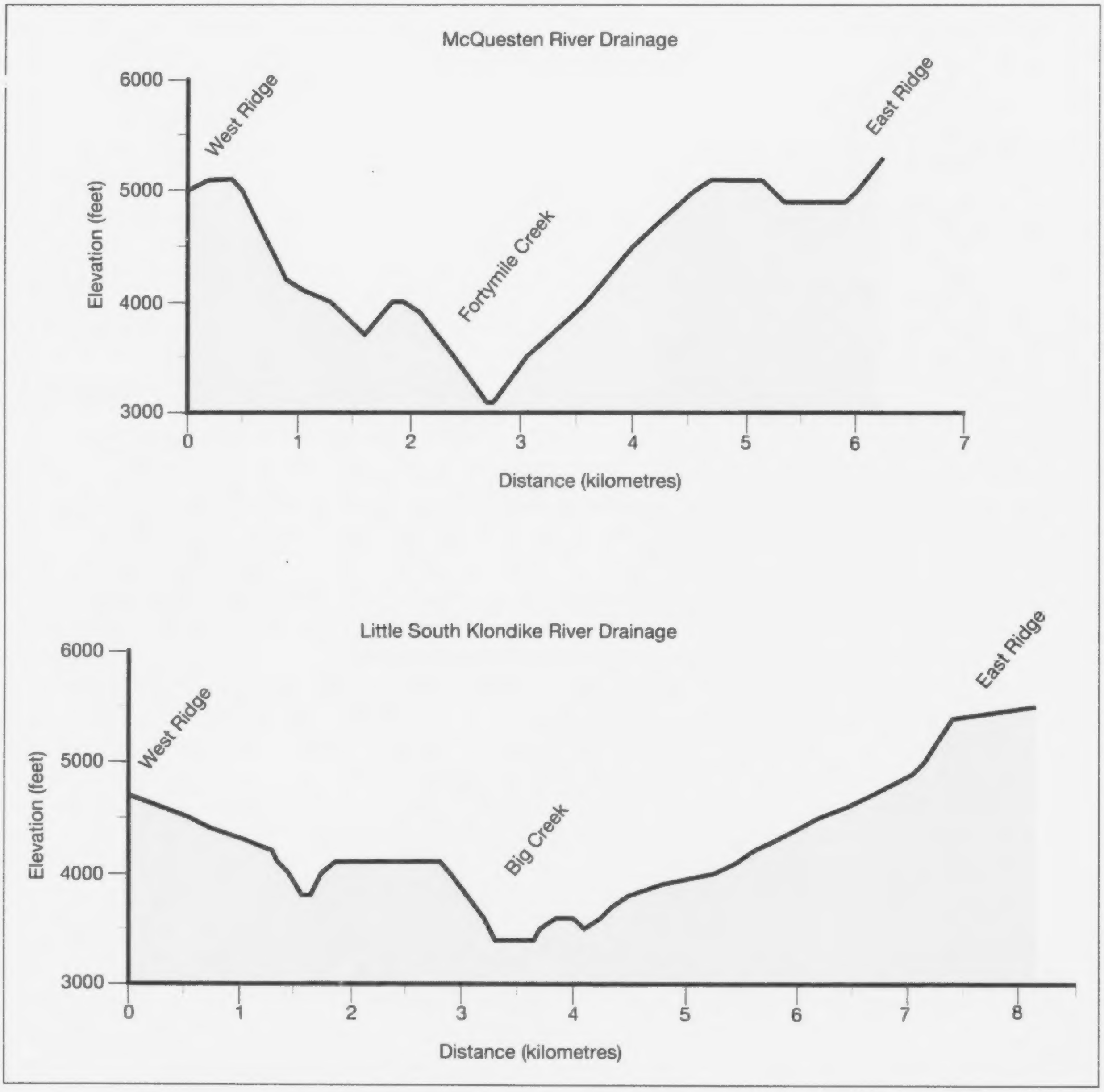


Figure 55. *Cross-valley profiles of Forty Mile Creek and Big Creek drainages. Note the difference in valley erosion between the two drainages. Location of East Ridge can be seen in the west-central area of Figure 2, while West Ridge is just off the map to the west.*

production has occurred in Hobo, Arizona and Gem creeks. Josephine and Big creek drain the east side of West Ridge, which is also shared by Left Clear Creek on the west side. Previous testing on Josephine Creek has been unsuccessful. Depths to bedrock along the lower reaches are from 2.1 to 2.7 metres and probably increase near the head of the drainage (Kreft, 1993), which is consistent with the glacial history. Local alpine glaciers developed at the headwaters during the McConnell and Reid glaciations, but their extent was limited to the upper-half of the creek (Bond, 1997b). Many small Tombstone Suite intrusions outcrop within the headwaters of these two drainages and provide favourable source rocks for gold. RGS data for Josephine and Big creeks show gold values >95th in both creeks and arsenic values also exceeded the 95th percentile. A stream sediment sample on Josephine Creek from the Mayo placer project returned a gold value of 355 ppb, the second highest gold value from the Mayo area sampling. Arsenic concentrations equaled 532 ppm, this is the fourth highest overall arsenic value. Prospects appear to have been tested in the lower reaches. The upper half of the creeks may be more promising where Reid glaciers overrode and possibly buried pre-existing placers.

Hobo and Gem creeks both have headwaters that originate within the Red Mountain stock, and in breccia zones northeast of the summit. Mining has occurred on both creeks but more extensively on Gem Creek where small-scale placer mining occurred over a 12-year period (Kreft, 1993). Hobo Creek has been prospected but the only mining has taken place near the mouth of Arizona Creek (Kreft, 1993). The alluvial deposits in that area consisted of 1 m of muck overlying 2 to 2.5 m of gravel (Kreft, 1993). The placer potential of Hobo Creek is favourable considering the bedrock setting at its headwaters. Economic grades may occur higher up in the drainage. The stream sediment geochemistry for Hobo Creek is anomalous in both gold and arsenic. Other creeks that have source areas on Red Mountain include tributaries to Ballard and Sprague creeks; these too have placer potential.

Arizona Creek lies 7 km west of Red Mountain and has a history of placer production. The ground is relatively shallow (approximately 4 m to bedrock) and is underlain by rocks of the Cambrian Gull Lake Formation (Kreft, 1993, Murphy and Héon, 1996). The drainage does not contain any reported intrusives or intrusion-altered metasedimentary rocks. Placer gold in Arizona Creek may have originated from veins related to the Red Mountain stock. The distinct north-northwest lineation of bedrock is likely bedding rather than structural control according to Murphy and Héon (1996). Structural control would have suggested a breccia-related gold source. Stream sediment geochemistry did not indicate any anomalous gold, arsenic or antimony values.

EMPIRE CREEK

Empire Creek is an isolated placer occurrence located 20 km southeast of Mayo in the Francis Creek drainage. Empire Creek flows south through a narrow incised valley off a broad plateau, informally termed Talbot Plateau, and into a large valley occupied by Francis Creek. Francis Creek drains southeast into Nogold Creek, which is an east-northeast flowing tributary of the Stewart River (Fig. 2 and Bond, 1999, in pocket). Placer mining has focused on the alluvial plain in the lower reaches of the valley. Coarse placer gold has been recovered, and recorded production has totalled 997 crude ounces (31 000 g) from a small operation that has been active since 1985 (Fig. 56). No other placers have been documented south of the Stewart River in the Mayo District other than Russell Creek 130 km to the southeast in the McMillan River drainage.

Empire Creek lies within the limit of the McConnell glaciation. Ice advancing west up Nogold Creek valley bifurcated into Francis Creek valley to the northwest (Fig. 3). The ice lobe terminated 10 km northwest of Empire Creek and only 4 km from the Stewart River valley ice lobe. Ice in Francis Creek valley was approximately 900 ft (270 m) thick at the mouth of Empire Creek valley and glaciated the lower reaches of the tributary valley. Limited ice scouring occurred in Empire Creek valley because of its orientation transverse to local ice flow.

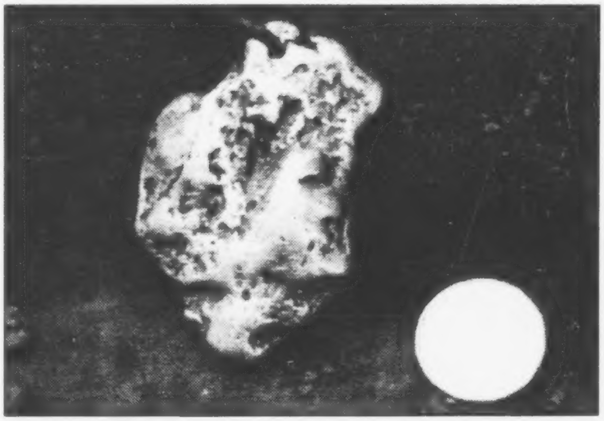


Figure 56. *Coarse placer gold is typical of Empire Creek. This 10-ounce (330 g) nugget was recovered by placer miner Don Sabo.*

During the retreat of McConnell ice from Francis Creek valley, outwash flowed northwest into the Stewart River valley. The surficial landform features indicate a change from a braided outwash river to a large incised meandering river in Francis Creek valley, as the McConnell ice front became more distant. Post-glacial downcutting in Francis Creek valley also lowered the base-level for tributary streams. This initiated erosion in Empire Creek valley and created the canyon on the lower reaches of the drainage basin (Fig. 57). The Empire Creek alluvial fan that developed during post-glacial downcutting likely consists of reworked McConnell glacial sediments and may include gold placers near the apex of the fan.

The stream sediment gold geochemistry of Empire Creek was below the detection limit of 5 ppb. Obviously, this does not reflect the gold placer deposit in the drainage. Perhaps the –80 mesh fraction used to determine the geochemical value is too fine. The placer gold in Empire Creek is coarse and may reflect a coarse lode source, such as vein gold that may not be detectable by this sampling method. Such sources may also prove difficult to detect because of the nugget effect, where the gold is coarse yet infrequent in the alluvium. Elsewhere in the Mayo district, this stream sediment sampling/geochemical method proved accurate in detecting the known gold placer deposit where it originates directly from a granitic or hornfels source. This is attributed to the fine disseminated gold particles that are typically produced from these sources.

Undiscovered placer deposits may exist in other streams that drain Talbot Plateau. Future exploration should focus on stream reaches that have had limited glacial erosion and a drop in base-level, similar to Empire Creek.

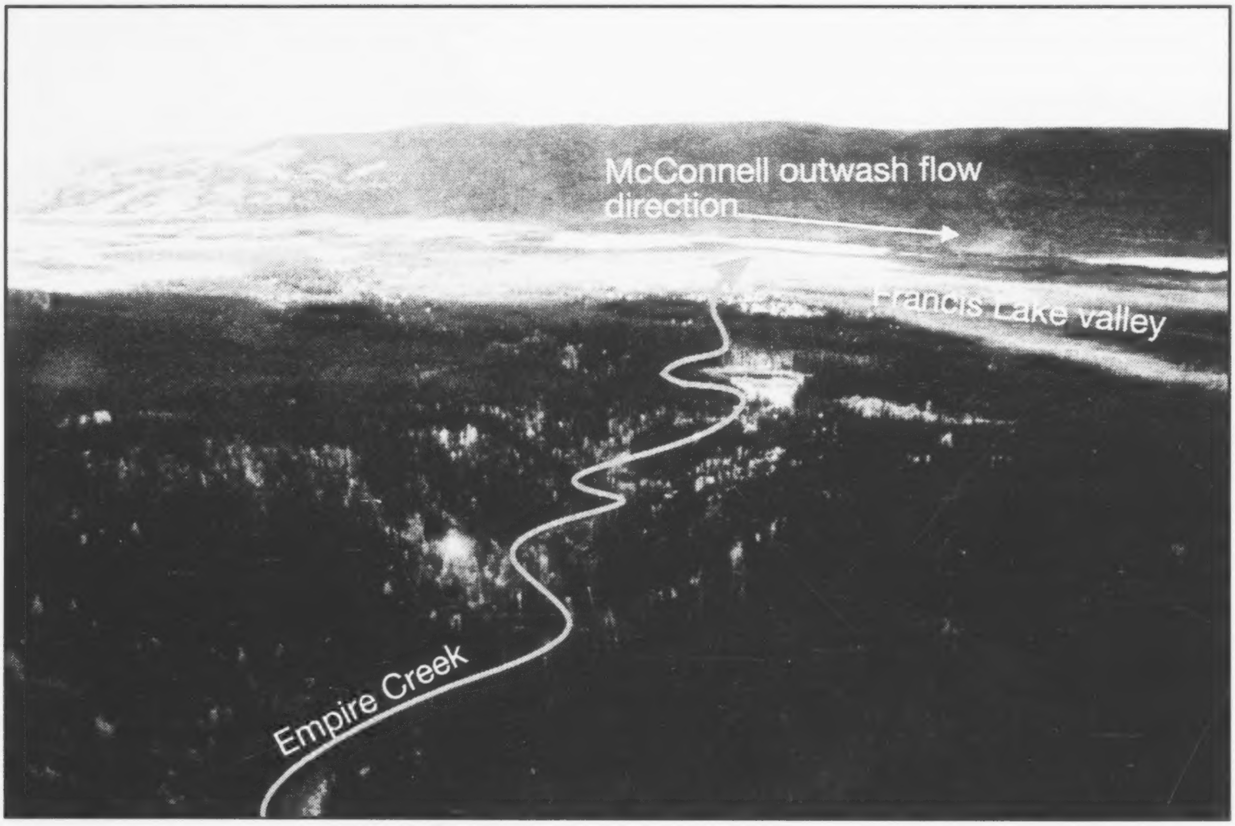


***Figure 57.** View of Empire Creek and Francis Lake valley looking west. The canyon on Empire Creek was created during the retreat of the McConnell ice sheet.*

HEAVY MINERAL STUDIES

INTRODUCTION

The goal of the heavy mineral study was to examine the heavy mineral fraction of samples from a variety of placer deposits and settings (gravel, till, soil samples, colluvium, terraces, etc.) and use this information to define possible relationships between the heavy mineral content, bedrock lithologies and mineral showings. In addition, study of the heavy mineral fraction provides information that can used to study provenance and transport mechanisms in fluvial deposits.

A conclusive heavy mineral study, of the type produced by Gleeson (1970) for the Klondike area, was beyond the scope of this study. Simple mineral extraction and mineral identification techniques were used. The cost-effective methodology developed for this study can be adopted by prospectors and exploration geologists interested in using heavy mineral analysis as an exploration tool. With the exception of 16 mineral grains which were sent for microprobe analysis, all mineral identifications in this study should be considered tentative, until confirmed by more sophisticated equipment.

From 1995 to 1997, 148 samples were collected for heavy mineral analysis. Walton Geological Services of Whitehorse, Yukon was commissioned to extract and study the heavy mineral fraction of the samples presented. Detailed results are given in Appendix 2.

METHODOLOGY

Sample processing and extraction of heavy minerals

The following procedure was followed:

1. The -18 mesh, -35 mesh and -60 mesh size fractions were combined and put into a black plastic gold pan and concentrated down to between 3 to 20 grams of heavy mineral concentrate.
2. The percentages of the magnetic and non-magnetic fractions were noted.
3. Each pan concentrate was checked for gold content before removal from the gold pan.
4. The pan concentrate was allowed to dry on a coffee filter perched on top of a paper plate.
5. The non-magnetic fraction of each dried pan concentrate was poured through a separating funnel containing methylene iodide. This procedure was carried out under a fume hood.
6. Minerals or rock fragments with a specific gravity greater than 3.32 sink to the bottom of the separating funnel. Minerals or rock fragments with a specific gravity less than 3.32 float on the surface of the methylene iodide.
7. The <3.32 fraction is removed with a spoon and discarded. The heavy mineral fraction (>3.32) is rinsed with ethyl alcohol and flushed out to dry on filter paper.
8. When dry, the filter paper is used as a trough to get the >3.32 fraction into a labeled glass vial.

Note 1. Methylene Iodide should be used under a fume hood and with strong plastic gloves, as it can be highly toxic to lethal.

Note 2. The above method does not a produce a completely "clean" heavy mineral concentrate, but was perfectly adequate for the purpose of this study. Gleeson (1970) recommends using a set of sluice boxes to produce a concentrate then using bromoform, a hand magnet and a Frantz isodynamic separator to remove the heavy minerals.

Note 3. It should be noted that the >3.32 mineral fraction also includes rock fragments. In some cases, rock fragments, as opposed to individual mineral grains made up almost 100% of the sample.

Examination of heavy mineral fraction

All microscope work was carried out at the Yukon Geology Program office in Whitehorse, Yukon. Basic mineral identification equipment was used, including:

- binocular microscope,
- longwave and shortwave ultraviolet light,
- pen-light and hand-held microscope with micrometer (for measuring the size of individual grains),
- a variety of magnets,
- fine-tipped tweezers,
- dilute HCl,
- dichroscope for determining pleochroism,
- a stainless steel pushpin and hardness points (for scratch tests) and,
- a wine cork with a needle stuck in it (the most used piece of equipment – for moving around mineral grains)

The heavy minerals were examined using the following procedure:

1. The >3.32 fraction was placed on black construction paper and examined under the binocular microscope.
2. The room lights were then turned off and the sample was examined under longwave and shortwave ultraviolet light. Due to the extremely small size of the mineral grains, the sample was aligned in the binocular microscope, and any fluorescence was observed under magnification by holding the ultraviolet light source as close as possible to the sample.
3. The room lights were turned back on and the sample was then placed on white paper.
4. The magnetite fraction was removed and the remaining mineral grains were examined.
5. If warranted, the <3.32 fraction was also examined.

Mineral identification was difficult due to the very small size of most mineral grains, which was, on average, less than 1.0 mm. Mineral identification was done using basic techniques (ultraviolet light, magnification, magnetism, and crystal form).

DISCUSSION

General

In general, the heavy minerals observed in samples collected in 1995 to 1997 show some variety in the degree of homogeneity of samples and in the angularity of the mineral grains. Many samples contain mostly euhedral heavy minerals or angular heavy mineral fragments indicating a nearby bedrock source. Rock fragments were abundant. The most abundant heavy minerals were magnetite, garnet and ilmenite in varying proportions. Samples from Highet Creek contain the most ilmenite.

In some cases, more gold was expected in samples than was actually observed or recovered. This result may be a function of gold loss during the sieving or splitting process. In addition, some of the gold particles may have been less than 120 mesh and were therefore not panned into a concentrate.

Gold

Of the 148 samples of heavy mineral concentrates, 45 contained some gold. Table 11 shows the heavy mineral content of all samples that contain gold grains. Most gold grains observed are rounded nuggets with little or no crystal form, however crystalline gold was noted in four samples. Sample FT8-95-1 contains two gold grains; one is a 0.2 mm flattened leaf, relatively crystalline with jagged, irregular edges, and the other is elongated leaf gold perched on a limonite-coated oxidized mineral grain (pyrite?). Both grains are bright yellow, very fresh looking and may indicate a gold-bearing vein deposit nearby. Sample LDG9702-01 contains one crystalline gold piece (0.4 mm) in addition to one rounded grain (0.3 mm). RUD-97-01-02 contains one mass of yellow gold (1.0 mm) with leafy to subcrystalline form and a smaller crystalline gold piece (0.3 mm). Sample LW-97-21 (Unit 1) contains six pieces of fresh, crystalline gold up to 0.6 mm in diameter. The crystalline gold is singular or perched on quartz matrix fragments. Subcrystalline gold was noted in samples MIC9704-02, WL-96-02, and LW-97-12.

Other heavy minerals

Magnetite, garnet and ilmenite are the most abundant heavy minerals other than gold. Schistose rock fragments were also very common. Significant other minerals include pyrite/goethite, staurolite, sphene, rutile, epidote, zircon, scheelite and hypersthene. Arsenopyrite was noted in three samples, while galena and boulangerite were each found in one sample.

Magnetite content in the samples varied dramatically, ranging from 0% to up to 70%. Samples from Haggart Creek and Gill Gulch contained little magnetite while some of the samples collected from pay gravels of individual workings contained up to 70% magnetite.

Pyrite was common along with geothite/limonite/hematite pseudomorphs after pyrite. Although pyrite occurs in trace (<1%) amounts in many of the samples, it comprises 80-90% of sample FT3-95-1/1 (Duncan Creek). Lustrous, unoxidized pyrite occurs in quantities greater than 25% in samples from McIntyre Creek (MIC9709-07) and Haggart Creek (LW97-01 (a), LW97-01 (b), LW9704, LW-97-22, and LW-97-27). Some pyrite grains showed extensive oxidation; the microprobe study confirmed that pyrite in many samples had been replaced by a hematite/goethite combination. These pseudomorphs after pyrite form cubes, pyritohedrons or anhedral blebs.

Garnet content was variable ranging from 0% to 45%. Sample FT2-95-9 (Duncan Creek) contained near gem-quality pink garnets.

Samples from Seattle Creek (SEA979701-03, SEA9703-02, SEA9705-02), and Rudolf Gulch (RUD9701-01, RUD9701-02 and RUD9701-03) were ilmenite-rich (up to 98%).

Table 11. Heavy mineral content of samples containing gold grains (L=low, M=medium, H=heavy, tr=trace, gr=grains, gvl=gravel).

Duncan Creek	**Yield**	**Gold**	**Magnetite**	**Ilmenite**	**Garnet**	**Scheelite**	**Pyrite**	**Hematite**
FT2-95-1/2 Unit1 (top)	L	4 gr	2-5	tr	2-5		tr	
FT3-95-1/1 Pay Unit1	L	2 gr	2-3	20-40	5-15		tr	
FT3-95-1/2 Unit1 area2	L	1 gr	<1	5-20	5-15		tr	
FT3-95-1/3 Unit1 area3	L-M	3 gr	<1	10-30			tr	tr
FT8-95-1 Lower Unit1	L	2 gr	1-2	10-20				
Taylors Pay1997	M	4 gr	10-15	30-50	3-5		2-5	
LW9601 (UD9601) Unit3	M-L	1 gr	2-5	70-90	5-10		1-3	
UD971-01(b)	L	2 gr	2-5	10-20				
Mayo Lake	**Yield**	**Gold**	**Magnetite**	**Ilmenite**	**Garnet**	**Scheelite**	**Pyrite**	**Hematite**
LDG9701-01	M-H	1 gr	5-10	50-70				
LDG9702-01	H	2 gr	10-15	40-60	5-10	<tr	<tr	
DVD9701-01	M-H	1 gr	45-55	40-50	2-3		tr	
DVD9702-01	M-H	3 gr	20-30	40-60	1-2	<<tr		
DVD9703	H	3 gr	40-60	25-35	1-2	<<tr		
Davidson Creek clay	M-H	2 gr	25-35	25-35	1-3	<<tr	5-10	
JB-96-50 Heavy #4	M	16 gr	75-90	10-15	1			2-3
JB-96-59 Heavy #5	M-L	1 gr	5-10	50-70	1-2		5-10	
Highet Creek	**Yield**	**Gold**	**Magnetite**	**Ilmenite**	**Garnet**	**Scheelite**	**Pyrite**	**Hematite**
MP1-95-2 Unit2 Pay gvl	L-M	39 gr	3-		1	tr		
WL9601 Unit1	M	1%	35-55	35-50	1	tr		
WL9601 Unit1	M	5 gr	50-60	40-50	1-3	tr		tr
WL9601 Unit2	M	1 gr	25-35	65-75		tr		
WL9601 Unit2	H	5 gr	55-65	40-45	1	tr		
WL9601 Unit4	M	1 gr	tr	90-95	1-3	tr		
HT3-95-1 Near old cabin	L-M	5 gr	10-15	50-80				
KK1-95-1 Unit1	M	20 gr	1-2	90-95		1		
WL96-02	L	1 gr	15-25	60-80	2-5		2-5	
RUD9701-01	M	3 gr	tr-1	95-98	tr	1-3		
RUD9701-02	M	2 gr	tr-1	95-98	tr	tr-1		
MIC9704-02	M	2 gr	5-10	40-60	15-25		1-2	
MIC9705-01	L	1 gr	5-10	40-60	5-10	tr		
MIC9706-01	H-M	3 gr	15-25	30-40	10-20	tr		
MIC9708-01	L-M	4 gr	5-10	25-50	20-35	tr	tr-1	
BEAR9702-01	L-M	1 gr	20-30	15-25	1-3	<<tr	tr	
Duncan Creek	**Yield**	**Gold**	**Magnetite**	**Ilmenite**	**Garnet**	**Scheelite**	**Pyrite**	**Hematite**
DK1-94-1A Pay	L	4 gr	5-10	5-15			tr	
DK1-94-1A Pay	L	4 gr	5-10	5-15	2-3		tr	
SEA9701-02	L-M	1 gr	2-5	50-70	2-5	<tr	tr	
SEA9703-02	M	3 gr	20-30	70-85	1-2	<tr		
SEA9705-02	M	1 gr	5-10	75-90	1-2	<tr		
ROD-97-01-04	H	2 gr	5-15	40-50	3-5			
Haggart Creek	**Yield**	**Gold**	**Magnetite**	**Ilmenite**	**Garnet**	**Scheelite**	**Pyrite**	**Hematite**
LW-97-01(a) Unit 1	H	>10 gr	tr				40-60	
LW-97-21 Unit 1	L	7 gr	tr	5-10	2-5	55-60	2-5	
LW9608 Section 2	M-H	7 gr	3	15-20	5-10	45-55	tr	20-30
LW-97-12 Unit 1	L-M	1 gr	1-2	2-5	2-5	tr		
LW96-09 Unit 1	M	1 gr	2-5	20-30		5-10		
JB-96-20 Heavy #2	M	1 gr	1-2		15-30	25-40		
JB-96-21 Heavy #3	M-L	1 gr			10-20	40-55		

Trace amounts of scheelite were present in many samples, especially from the Haggart Creek drainage. Two samples from Dublin Gulch included up to 65% scheelite (LW-97-20, LW-97-21). Samples from Gill Gulch also contained abundant scheelite (up to 10%). Sample LW-97-15 contained 2-3% scheelite and samples RUD9701-01, RUD97-01-02 and RUD97-01-03 contained 1-3% scheelite.

In addition to scheelite, many of the samples from Haggart Creek and Dublin Gulch (LW-97-22 Unit 2) contain euhedral cassiterite, along with arsenopyrite and boulangerite. Two samples from Gill Gulch were unusual: sample LW-97-09 Unit 1 contained manganese andradite-spessartine garnets, and sample LW-97-12 Unit 1 contained one grain of bright yellow subcrystalline gold (0.4 mm), 2-5% rutile, 1% anatase, a trace of crystalline cassiterite and one corundum crystal. The corundum crystal has six-sided columnar form, subadamantine lustre, and a light grey color.

Duncan Creek samples commonly contained staurolite. Hematite content was low except in a few samples from Haggart Creek and Duncan Creek.

A topaz crystal was noted in a heavy mineral concentrate from a glaciofluvial terrace near the outlet of Keystone Creek on Mayo Lake.

CONCLUSIONS

The presence of unweathered, crystalline gold in sample FT8-95-1 (Duncan Creek) indicates a possible undiscovered bedrock source of gold nearby. Bedrock mineralization in lower Duncan Creek is also indicated by euhedral, unoxidized arsenopyrite and pyrite crystals in sample FT2-95-1/1.

Samples LDG9702-01 (Ledge Creek), RUD97-01-02 (Rudolf Gulch) and LW-97-21 (Dublin Gulch) also contain crystalline unweathered gold, indicating nearby bedrock sources. While Rudolph Gulch drains the Scheelite dome occurrence (Yukon MINFILE, 1997, 115P 004) and Dublin Gulch drains the Potato Hills Stock (Yukon MINFILE, 1997, 106D 025), no bedrock gold source has been identified near Ledge Creek.

The most interesting samples, in terms of crystalline/subcrystalline gold, interesting sulphide or oxide mineral content or unusual minerals are:

LDG-97-03-01	Ledge Creek	crystalline gold
RUD-97-01-02	Rudolph Gulch	leafy, subcrystalline gold
LW-97-01 (a)	Haggart Creek	pyrite, arsenopyrite, gold
LW-97-01 (b)	Haggart Creek	pyrite, malachite, trace arsenopyrite
LW-97-04	Haggart Creek	pyrite, trace arsenopyrite, trace boulangerite
LW-97-12	Gill Gulch	subcrystalline gold, corundum
LW-97-16	Fisher Gulch	cassiterite
LW-97-17	Fisher Gulch	cassiterite
LW-97-21	Dublin Gulch	crystalline gold on quartz
LW-97-22	Dublin Gulch	pyrite, arsenopyrite, boulangerite
LW-97-27	Haggart Creek	pyrite, arsenopyrite, scheelite, cassiterite
JB96-50	Keystone Creek	topaz, gold

PLACER DEPOSIT SETTINGS AND EXPLORATION TARGETS

INTRODUCTION

Based on stratigraphic relationships and sedimentology, several placer deposit models may be described within the glacial limits of central Yukon, including the Mayo area. These can be grouped into modern, interglacial, glacial or periglacial placer settings. Figure 58 shows these settings in a schematic profile.

MODERN PLACERS

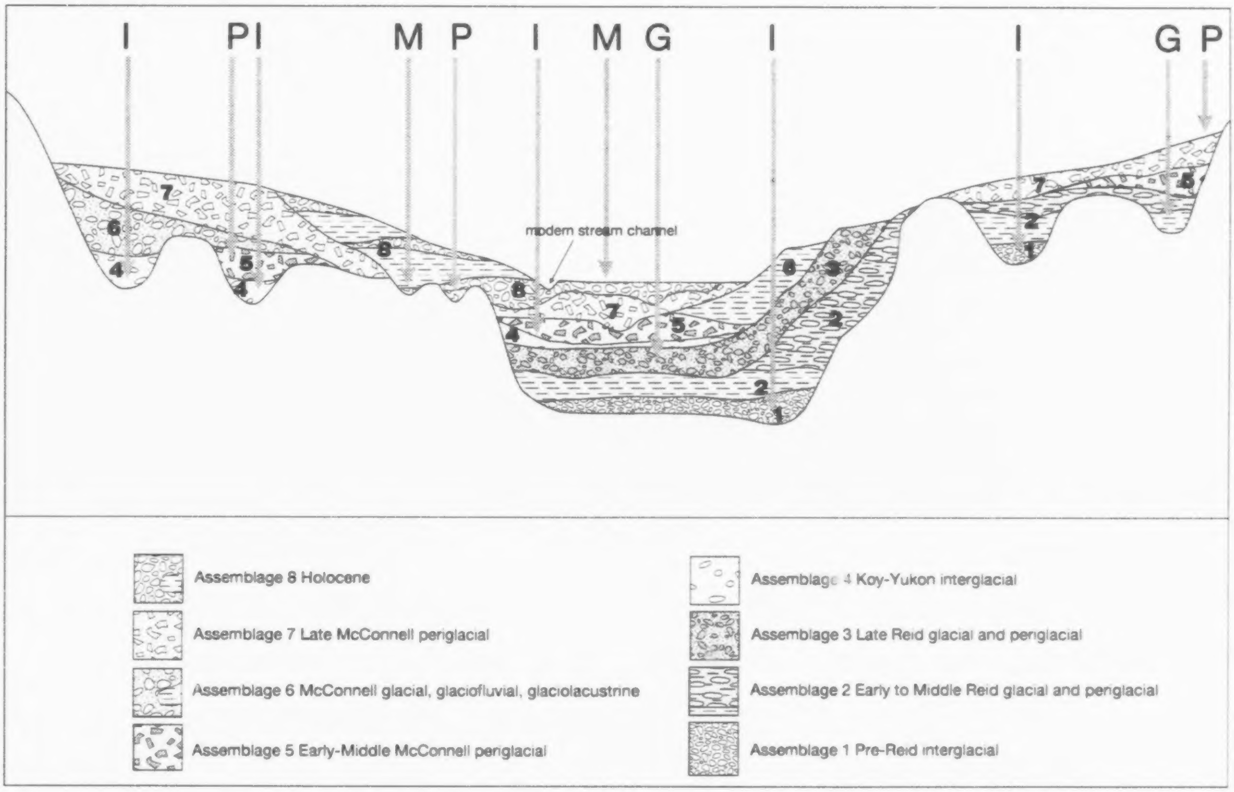
Modern placer deposits occur in floodplains, low alluvial terraces, alluvial fans, fan-deltas and gulches. These deposits are historically the most common type of placer to be mined throughout the Mayo area.

In the Duncan Creek drainage, modern placers occur in the floodplain, in gulch gravels in tributary valleys (including Thunder Gulch), and in side-valley alluvial fans. Within the floodplain of Duncan Creek, significant placers occur where the stream has incised to bedrock on the valley rim.

In the Mayo Lake area, modern placers occur in gulch deposits in tributary valleys and in related alluvial fan deltas, which drain into Mayo Lake.

In Highet Creek, modern placers mainly occur in tributary gulches and in the floodplain near the upper reaches of the drainage basin, where depth to bedrock is shallow.

In the Haggart Creek drainage, modern placers occur in the floodplain of Haggart Creek and in tributary valleys including Dublin Gulch and Fisher Gulch. Side-valley alluvial fans along Haggart and possibly Lynx creeks also contain placer deposits near their apex. In addition, these fans have buried part of the Late McConnell to Modern placer-deposit-bearing floodplain.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Assemblage 8 Holocene
Assemblage 7 Late McConnell periglacial
Assemblage 6 McConnell glacial, glaciofluvial, glaciolacustrine
Assemblage 5 Early-Middle McConnell periglacial
Assemblage 4 Koy-Yukon interglacial
Assemblage 3 Late Reid glacial and periglacial
Assemblage 2 Early to Middle Reid glacial and periglacial
Assemblage 1 Pre-Reid interglacial

Figure 58. *Schematic cross-valley profile showing placer deposit settings and potential exploration targets in idealized stratigraphic settings. M - Modern, I - Interglacial, P - Periglacial, G - Glacial. Note that most targets are buried. Not to scale.*

In the South McQuesten drainage basin, including Seattle and Rodin creeks, modern placer deposits occur as gulch gravel in high gradient tributary valleys.

Potential new exploration targets include Modern stream placers in point and channel bars along Stewart River and gulch placers in high gradient tributaries throughout Mayo area.

INTERGLACIAL PLACERS

Interglacial placer deposits include alluvial plains, alluvial fans, and terraces and gulch deposits that may be subsequently buried and reworked by glacial drift and periglacial fan sediments. Within the glacial limit, interglacial placer deposits are best preserved near the terminus, especially in valleys oriented perpendicular or oblique to ice-flow, where the scouring of pre-existing sediment is minimal and depositional processes are dominant.

On Upper Duncan Creek above the canyon, alluvial fans containing pre-McConnell interglacial placer deposits are buried by periglacial sediments and colluvial deposits of McConnell age.

Buried interglacial placer deposits occur in the South McQuesten drainages of Seattle and Goodman creeks, outside of the McConnell ice limit where McConnell age periglacial fans have built out onto the interglacial floodplain.

On the lower reaches of Highet Creek, pre-Reid interglacial gravel is preserved beneath Reid glaciolacustrine sediments and till. Ice advancing in the valley of Minto Creek blocked Highet Creek and formed an ice marginal lake, which subsequently protected underlying sediments from the scouring effects of the advancing glacier. On Ledge Creek, a Mayo Lake tributary, interglacial gulch gravels are buried beneath McConnell glacial till and glaciofluvial outwash deposits. Unexplored placer targets of this type may occur on the drainages of Upper Duncan, Lightning, Minto, Highet, Haggart and Lynx creeks, Thunder gulch, and on tributaries of Mayo Lake.

GLACIAL PLACERS

Glacial placer settings include glacial till and glaciofluvial outwash gravel in major valleys. In central Yukon, the most significant gold-bearing placers of these types are Reid age or older. Glacial till commonly forms placer deposits in areas where local alpine glaciers have scoured and incorporated weathered bedrock and pre-existing placers. This settting occurred in the Gustavus Range, where alpine glaciers developed during both the Reid and McConnell glaciations. During the Reid glaciation, ice advanced down Upper Duncan Creek valley and reconcentrated placers into a till near the mouth. At McNeill gulch, placer gold is dispersed throughout a moraine that formed during the McConnell glaciation, when ice advanced down an alpine valley.

Glaciofluvial outwash placer deposits may form when meltwater flows from streams proximal to an active glacier. Favourable conditions for placer deposits exist when meltwater is erosive rather than depositional, such as when glaciers breach drainage divides and send an initial flux of meltwater into a drainage; and during the waning stages of glaciation, when base levels are unstable in heavily glaciated valleys. On Duncan creek, Reid outwash eroded interglacial sediments upstream and reconcentrated placers on bedrock in the lower reaches. This also occurred to some extent on Seattle Creek. Potential new exploration targets include glacial and glaciofluvial placers on Duncan, Goodman and Seattle creeks.

PERIGLACIAL PLACER DEPOSITS

In periglacial placer settings, alluvial fans may form just outside of the glacial limit due to increased physical weathering and slope erosion. In many cases, these fans buried and reworked paleoplacers, while in others, colluvial placer deposits formed because of the intense physical breakdown and slope erosion of bedrock gold sources. On Seattle Creek and Goodman Creek, tributaries to the South McQuesten River, periglacial sediments mark the initial period of fan development and have buried paleoplacers that may be Reid age glacial outwash. Some periglacial sediments on Seattle Creek also contain placer gold where it has been incorporated from pre-existing interglacial sources. Potentially unexplored targets include tributaries of Mayo Lake (such as Cliff and Cascade creeks) and South McQuesten River, including Seattle Creek and Haggart Creek.

CONCLUSIONS

Information developed in this study allows us to make the following conclusions:

1. The study area was subjected to at least three major episodes of glaciation, including the pre-Reid (multiple episodes), Reid and McConnell. No evidence of a mid-Wisconsinan glaciation was found during the study. Ice-flow directions during the Reid and McConnell glaciations were topographically controlled and oriented from east to west and northeast to southwest.

2. Base-level changes are the most important factor in the formation, preservation and exposure of placer deposits.

3. Significant placer deposits likely lie buried in valleys that were not excavated during base-level changes in post-glacial and modern times.

4. Placer deposits occur in modern, interglacial, glacial and periglacial settings.

5. The formation and preservation of these placer deposits can be directly attributed to both the presence of local bedrock sources of gold, and the location and orientation of the placer deposits relative to paleo-ice flow and the direction of glaciofluvial meltwater channels.

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Appendix 1. Location of stratigraphic sections measured in the Mayo area, 1995-1998

Appendix 1a. Duncan Creek area, 1995-1998

Section name	NTS	Latitude Dec. deg. N	Longitude Dec. deg. W	Elevation feet	Geologists	Creek	Landform
DC1-95	105M/14	63°52.52	135°21.93	3140	WPL	Duncan	alluvial bench
DC2-95	105M/14	63°52.78	135°22.63	2920	WPL	Duncan	alluvial bench
UD9602	105M/14	63°52.64	135°18.45	3240	WPL/FJH	Upper Duncan	fluvial valley
FH9601	105M/14	63°52.21	135°11.48	4150	FJH	Upper Duncan	fluvial valley
FH9602	105M/14	63°52.64	135°18.45	3240	FJH	Upper Duncan	fluvial valley
FH9603	105M/14	63°52.52	135°20.60	2770	FJH	Upper Duncan	alluvial bench
FH9604	105M/14	63°48.30	135°29.52	2450	FJH	Duncan	alluvial bench
FH9605	105M/14	63°53.64	135°21.30	2880	FJH	Duncan	alluvial bench
FH9606	105M/14	63°49.27	135°28.91	2490	FJH	Duncan	alluvial bench
FH9607	105M/14	63°49.18	135°28.98	2480	FJH	Duncan	alluvial bench
FH9608	105M/14	63°50.36	135°38.00	2550	FJH	Duncan	alluvial bench
FH9609	105M/14	63°50.68	135°27.16	2600	FJH	Duncan	alluvial bench
FH9610	105M/14	63°51.13	135°26.31	2640	FJH	Duncan	alluvial bench
FH9611	105M/14	63°51.68	135°25.07	2660	FJH	Duncan	alluvial bench
FH9612	105M/14	63°52.74	135°22.65	2740	FJH	Duncan	paleo-alluvial fan
FH9614	105M/14	63°53.07	135°19.91	3030	FJH	Upper Duncan	fluvial valley
FH9616	105M/14	63°55.20	135°12.00	3700	FJH	Hope Gulch	gulch mouth
FH9617	105M/14	63°56.60	135°22.19	2770	FJH	Galena Hill	colluvial slope
FH9618	105M/14	63°53.97	135°15.07	3790	FJH	unnamed Tributary	gulch valley
FH9619 (1)	105M/14	63°54.00	135°14.77	3710	FJH	Thunder Gulch	gulch valley
FH9619 (2)	105M/14	63°54.08	135°14.92	3750	LCW	Thunder Gulch	gulch valley
FH9620	105M/14	63°48.90	135°28.81	2500	FJH	Duncan	fluvial valley
FT1-95	105M/14	63°48.57	135°29.20	2420	WPL	Duncan	fluvial valley
FT2-95	105M/14	63°48.63	135°29.07	2420	WPL	Duncan	fluvial valley
FT3-95	105M/14	63°48.72	135°29.05	2420	WPL	Duncan	fluvial valley
FT4-95	105M/14	63°48.78	135°29.00	2420	WPL	Duncan	fluvial valley
FT5-95	105M/14	63°48.88	135°28.90	2380	WPL	Duncan	fluvial valley
FT6-95	105M/14	63°48.88	135°28.87	2460	WPL	Duncan	fluvial valley
FT7-95	105M/14	63°47.32	135°30.35	2480	WPL	Duncan	fluvial valley
FT8-95	105M/14	63°47.53	135°30.05	2320	WPL	Duncan	fluvial valley
General	105M/14	63°52.64	135°18.45	3300	FJH	Upper Duncan	fluvial valley
General	105M/14	63°52.65	135°18.46	3180	FJH	Upper Duncan	fluvial valley
General	105M/14	63°52.63	135°18.36	3225	FJH	Upper Duncan	fluvial valley
General	105M/14	63°52.64	135°18.44	3250	FJH	Upper Duncan	fluvial valley
HB1-95	105M/14	63°53.05	135°19.50	3350	WPL	Upper Duncan	fluvial valley
HB2-95	105M/14	63°52.63	135°18.43	3220	WPL	Upper Duncan	fluvial valley
HB3-95	105M/14	63°52.63	135°52.63	3320	WPL	Upper Duncan	fluvial valley
HB4-95	105M/14	63°53.47	135°20.57	2940	WPL	Upper Duncan	fluvial valley
LW9601	105M/14	63°52.61	135°18.36	3235	LCW	Upper Duncan	alluvial terrace
LW9602	105M/14	63°52.64	135°18.45	3160	LCW	Upper Duncan	fluvial valley
LW9603	105M/14	63°53.08	135°19.88	3170	LCW	Upper Duncan	fluvial valley
LW9604	105M/14	63°53.05	135°19.83	3120	LCW	Upper Duncan	fluvial valley wall
LW9605	105M/14	63°52.21	135°11.48	4150	LCW	Upper Duncan	fluvial valley
LW9607	105M/14	63°47.53	135°30.05	2320	LCW	Duncan	alluvial terrace
LW9608A	105M/14	63°50.51	135°27.47	2550	FJH	Duncan	alluvial terrace
WL9603	105M/14	63°48.88	135°28.87	2460	LCW/WPL	Duncan	alluvial valley
UD9701	105M/14	63°53.36	135°20.48	3000	WPL, TLA, EK	Upper Duncan	alluvial terrace
UD9702	105M/14	63°53.36	135°20.48	3000	WPL, TLA, EK	Upper Duncan	alluvial terrace
UD9703	105M/14	63°53.28	135°20.25	3000	WPL, TLA, EK	Upper Duncan	alluvial terrace
FT97-01	105M/14	63°49.01	135°28.56	2480	WPL	Duncan	alluvial valley
FT98-1-1	105M/14	63°49.08	135°28.50	2480	WPL	Duncan	alluvial valley
FT98-1-2	105M/14	63°49.08	135°28.50	2480	WPL/MS	Duncan	alluvial valley
FT98-1-3	105M/14	63°49.08	135°28.50	2480	WPL/MS	Duncan	alluvial valley

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Appendix 1b. Mayo Lake area, 1995-1997

Section name	NTS	Latitude Dec. deg. N	Longitude Dec. deg. W	Elevation feet	Geologists	Creek	Landform
FH9621	105M/11	63°44.85	135°25.65	2680	FJH	Davidson	canyon
FH9622	105M/11	63°44.00	135°25.50	2600	FJH	Davidson	canyon
LW9606	105M14	63°47.64	135°14.35	2450	LCW	Dirksen	fan delta
MW1-95	105M/11	63°43.67	135°01.57	2400	WPL	Anderson	canyon
AC9701	105M/11	63°43.78	135°01.54	2320	WPL, DM, TLA	Anderson	alluvial fan-delta
Ledge Ck	105M/10	63°41.50	134°51.50	2500	FJH	Ledge	alluvial fan apex
RB1-95	105M/10	63°40.62	134°50.67	2450	WPL	Ledge	alluvial fan apex
LDG97-01	105M/10	63°40.90	134°50.34	2800	TLA, DM, LM	Ledge	canyon/alluvial fan
LDG97-02	105M/10	63°40.63	134°50.49	2450	LM, DM	Ledge	alluvial fan apex
LDG97-03	105M/10	63°40.63	134°50.49	2500	TLA, DM	Ledge	canyon/alluvial fan
DVD9701	105M/11	63°43.76	135°25.09	2400	TLA, JB	Davidson	canyon
DVD9702	105M/11	63°43.85	135°25.12	2400	TLA, JB	Davidson	canyon
DVD9703	105M/11	63°43.85	135°25.12	2400	TLA, DP	Davidson	canyon

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Appendix 1c. Highet Creek/Minto Lake area, 1995-1997

Section name	NTS	Latitude Dec. deg. N	Longitude Dec. deg. W	Elevation feet	Geologists	Creek	Landform
FE1-95	115P/16	63°45.92	136°12.82	3450	WPL	Highet	fluvial valley
FH9615	115P/9	63°44.20	136°05.20	2580	FJH	Highet	fluvial valley
HT1-95	115P/16	63°45.85	136°10.72	2980	WPL	Highet	fluvial valley
HT2-95	115P/9	63°43.93	136°07.82	2500	WPL	Highet	fluvial valley
HT3-95	115P/9	63°43.88	136°07.77	2500	WPL	Highet	fluvial valley
KK1-95	115P/16	63°45.92	136°11.52	3125	WPL	Highet	alluvial terrace
MP1-95	115P/9	63°44.27	136°08.58	2560	WPL	Highet	fluvial valley
WL961-2	115P/9	63°44.40	136°08.50	2565	WPL	Highet	alluvial valley
HCR9701	105M/12	63°43.33	135°59.47	2070	TA, DM	Minto	alluvial terrace
HCR9702	115P/9	63°43.43	136°00.12	2100	TA, DM	Minto/Roaring Fork	alluvial terrace
HCR9703	115P/9	63°43.45	136°03.04	2180	TA, DM	Minto	alluvial terrace
HCR9704	115P/9	63°45.68	136°11.83	3290	TA, LM	Highet/Rudolf	alluvial valley
MIC9701	115P/9	63°43.14	136°07.68	2500	TA	McIntyre	alluvial valley
MIC9702	115P/9	63°43.17	136°07.24	2450	TA	McIntyre	alluvial valley
MIC9703	115P/9	63°43.16	136°07.38	2500	TA, MS	Minto	glaciofluvial terrace
MIC9704	115P/9	63°42.93	136°06.93	2300	TA, MS	Minto	glaciofluvial terrace
MIC9705	115P/9	63°42.93	136°06.93	2300	TA, MS	Minto	glaciofluvial terrace
MIC9706	115P/9	63°42.93	136°06.93	2300	TA, MS	Minto	glaciofluvial terrace
MIC9707	115P/9	63°43.23	136°07.24	2550	TA, MS	Minto	glaciofluvial terrace
MIC9708	115P/9	63°42.31	136°07.96	2350	TA, MS	Minto	glaciofluvial terrace
MIC9709	115P/9	63°42.22	136°08.04	2400	TA, MS	Minto	glaciofluvial terrace
MIC9710	115P/9	63°42.01	136°07.87	2300	TA, MS	Minto	glaciofluvial terrace
MIC9711	115P/9	63°42.18	136°08.10	2400	TA, DM	Minto	glaciofluvial terrace
MLN9701	115P/9	63°42.53	136°13.39	2800	TA, DM	McLagan	alluvial valley
MLN9702	115P/9	63°41.70	136°13.57	2400	TA, DM	McLagan	alluvial valley
RUD9701	115P/16	63°40.77	136°11.57	3350	TA, LM	Rudolph	gulch
N.BEAR9601	115P/9	63°41.26	136°20.97	2450	WPL, LCW	North Bear	gulch
N.BEAR9602	115P/9	63°41.25	136°20.97	2400	WPL, LCW	North Bear	gulch
BEAR9701	115P/9	63°41.33	136°20.82	2400	WPL, TA, LM	North Bear	gulch
BEAR9702	115P/9	63°41.33	136°21.12	2450	WPL, TA, LM	North Bear	gulch

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Appendix 1d. Haggart Creek area, 1995-1997

Section name	NTS	Latitude Dec.deg. N	Longitude Dec.deg. W	Elevation feet	Geologists	Creek	Landform
RH1-95-2	106D/4	64°01.03	135°51.18	2530	WPL	Haggart	remnant moraine
RH2-95-1	106D/4	64°00.90	135°51.07	2540	WPL	Haggart	alluvial valley
LW9701	106D/4	64°00.92	135°50.88	2500	LW, LM	Haggart	alluvial valley
LW9702	106D/4	64°00.80	135°50.88	2475	LW, LM	Haggart	alluvial valley
LW9703	106D/4	64°00.85	135°50.88	2485	LW, LM	Haggart	alluvial valley
LW9704	106D/4	64°00.72	135°50.88	2450	LW, LM	Haggart	alluvial valley
LW9705	106D/4	64°00.70	135°50.88	2450	LW, LM	Haggart	alluvial valley
LW9706	106D/4	64°00.82	135°50.88	2480	LW, LM	Haggart	alluvial valley
LW9707	106D/4	64°00.95	135°50.88	2520	LW, LM	Haggart	alluvial valley
LW9708	106D/4	64°00.95	135°50.88	2520	LW, LM	Haggart	alluvial valley
LW9709	106D/4	64°01.68	135°51.25	2440	LW, LM	Haggart	alluvial valley
LW9710	106D/4	64°01.68	135°51.25	2440	LW, LM	Haggart	alluvial valley
LW9711	106D/4	64°01.65	135°51.25	2445	LW, LM	Haggart	alluvial valley
LW9712	106D/4	64°01.60	135°51.20	2420	LW, LM	Haggart	alluvial valley
LW9713	106D/4	64°01.53	135°51.12	2410	LW, LM	Haggart	alluvial valley
LW9714	106D/4	64°01.63	135°51.18	2415	LW, LM	Haggart	alluvial valley
LW9715	106D/4	64°01.02	135°50.88	2520	LW, LM	Haggart	alluvial valley
LW9716	106D/4	64°02.40	135°52.07	2800	LW, LM	Haggart	alluvial valley
LW9717	106D/4	64°02.38	135°52.15	2825	LW, LM	Haggart	alluvial valley
LW9718	106D/4	64°02.13	135°49.55	2890	LW, LM	Haggart	alluvial valley
LW9719	106D/4	64°02.07	135°49.25	2975	LW, LM	Haggart	colluvial apron
LW9720	106D/4	64°02.00	135°49.68	2825	LW, LM	Haggart	alluvial valley
LW9721	106D/4	64°02.00	135°49.78	2790	LW, LM	Haggart	periglacial fan
LW9722	106D/4	64°01.87	135°50.18	2750	LW, LM	Haggart	remnant moraine
LW9723	106D/4	64°01.83	135°51.43	2720	LW, LM	Haggart	alluvial valley
LW9724	106D/4	64°00.53	135°51.18	2430	LW, LM	Haggart	colluvium
LW9725	106D/4	64°00.53	135°51.18	2420	LW, LM	Haggart	alluvial valley
LW9726	106D/4	64°00.43	135°51.18	2435	LW, LM	Haggart	alluvial valley
LW97275	106D/4	64°00.43	135°51.18	2400	LW, LM	Haggart	alluvial valley
GILL 3	106D/4	64°01.63	135°51.18	2415	LW, FH	Gill Gulch	alluvial valley
GILL 4	106D/4	64°01.68	135°51.25	2440	LW, FH	Gill Gulch	alluvial valley

JB=Jeff Bond
EK=Erika Kotler
WPL=Bill LeBarge
TLA, TA=Tammy Allen
LM=Lisa MacKinnon
LCW, LW=Leyla Weston
DM=Dylan MacGregor
MS=Mark Skidmore
DP=Dean Pollard
FJH=Fran Hein

Appendix 1e. South McQuesten/Seattle Creek area, 1995-1997

Section name	**NTS**	**Latitude Dec. deg. N**	**Longitude Dec. deg.W**	**Elevation feet**	**Geologists**	**Creek**	**Landform**
DK1-95	115P/16	63°49.38	136°04.13	2550	WPL	Seattle	periglacial alluvial fan
KK2-95	115P/16	63°55.60	136°11.55	2375	WPL	Goodman	periglacial alluvial fan
SEA9701	115P/16	63°49.28	136°04.04	2600	TA, WPL	Seattle	periglacial alluvial fan
SEA9702	115P/16	63°49.28	136°04.04	2550	TA, WPL	Seattle	periglacial alluvial fan
SEA9703	115P/16	63°49.28	136°04.03	2550	TA, WPL	Seattle	periglacial alluvial fan
SEA9704	115P/16	63°49.28	136°04.03	2550	TA, WPL	Seattle	periglacial alluvial fan
SEA9705	115P/16	63°49.38	136°04.01	2550	TA, WPL	Seattle	periglacial alluvial fan
GDM9701	115P/16	63°54.65	136°09.69	2100	TA, WPL, DP	Goodman	periglacial alluvial fan
GDM9702	115P/16	63°54.36	136°09.37	2050	TA, WPL, DP	Goodman	periglacial alluvial fan
ROD9701	115P/16	63°53.15	136°17.78	2500	WPL, TA, DM	Rodin	periglacial alluvial fan

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Appendix 2. Heavy mineral analysis, additional notes

FT2-95-1/1 Duncan Creek Duncan Section 2 Unit 1 (bottom)
Very interesting sample due to the presence of euhedral arsenopyrite crystals with striated faces. Some of the arsenopyrite crystals are in quartz matrix. There is abundant limonite coated pyrite. Five small grains of scheelite were noted under shortwave ultraviolet light. Also 5-10% of the sample consists of fresh, euhedral unoxidized pyrite. About 1-5% of the pyrite shows a purple iridescent tarnish. One brownish yellow striated twinned crystal which might be cassiterite was observed. Orange-yellow limonite-coated grains comprise 10-20% of the sample.

FT2-95-1/2 Duncan Creek Duncan Section 2 Unit 1 (top)
Mainly rock fragments. Four rounded nuggets of gold from 1.0 mm to <0.2 mm.

FT295-2 Duncan Creek Duncan Section 2 Unit 2
Mainly rock fragments.

FT2-95-3 Duncan Creek Duncan Section 2 Unit 3
Mix of many different mineral and rock grains. Abundant rock fragments.

FT2-95-5 Duncan Creek Duncan Section 2 Unit 5
Grain size of sample is consistent. Under ultraviolet light, there are 20 small grains which fluoresce moderate green-yellow under both longwave and shortwave light. The grains are white to clear in overhead light, tabular, and display at least one good cleavage. Might be celestite? ($SrSO_4$).

FT2-95-7 Duncan Creek Duncan Section 2 Unit 7
Mainly rock fragments, ilmenite.

FT2-95-9 Duncan Creek Duncan Section 2 Unit 9
Ilmenite, nice gemmy pink garnets.

FT2-95-10 Duncan Creek Duncan Section 2 Unit 10
Very low heavy mineral yield.

FT2-95-13 Duncan Creek Duncan Section 2 Unit 13
Mainly light coloured minerals and rock fragments. Also get 1-2% euhedral fresh to slightly oxidized pyritohedrons.

FT3-95-1/1 Duncan Creek Unit 1 (pay)
Many grains are coated with limonite. The two gold grains are rounded and flattened. There is one grain which fluoresces blue-white under both longwave and shortwave ultraviolet light. Under visible light the same grain is a very thin white plate which is sectile and has a pearly lustre – brucite?

FT3-95-1/1 Duncan Creek Unit 1 (pay) bottom
Pyritiferous concentrate. Sample contains 10-20% platy black mineral with white alteration rim; this is most likely a leucoxene coating on ilmenite. Leucoxene is an amorphous chemically variable titanium oxide which is gray to white and forms as a result of alteration of titanium-rich minerals. Between 10 to 15 grains fluoresce medium-faint white, slightly blue under longwave and shortwave ultraviolet light and are white under visible light (mineral is unidentified). The <3.32 fraction contains abundant pyrophyllite? or talc?.

FT3-95-1/2 Duncan Creek Unit 1 Area 2
One thin flake gold.

FT3-95-1/3 Duncan Creek Unit 1 Area 3
Three flat, rounded gold flakes; the largest is 0.05 mm.

FT3-95-1/4 Duncan Creek Unit 1 Area 4
Abundant ilmenite. Garnet is the next most abundant mineral (5-10%), then magnetite (2-4%). Trace amounts of zircon and pyrite were noted. This sample strongly resembles FT3-95-1/5 and FT3-95-1/6.

FT3-95-1/5 Duncan Creek Unit 1 Area 5
This sample is very similar to FT3-95-1/4 and FT3-95-1/6.

FT3-95-1/6 Duncan Creek Unit 1 Area 6
Sample is very similar to FT3-95-1/4 and FT3-95-1/5.

FT4-95-1 Duncan Creek Duncan Section 4 Unit 1 – organic?
Up to 10% limonite. There is 5-15% pyrite content, of which 2-5% are goethite/hematite pseudomorphs after pyrite.

FT4-95-5 Duncan Creek Duncan Section 4 Unit 5 – organic?
Very low yield. Mainly rock fragments.

FT8-95-1 Duncan Creek Duncan Creek bank section lower unit
Sample consists mainly of rock fragments and ilmenite, with minor magnetite. There are two gold grains; one is a flattened leaf, relatively crystalline. The other gold grain is elongated leafy gold, relatively crystalline, perched on a limonite-coated, rusty mineral grain (pyrite?).

FT8-95-7 Duncan Creek Bend section contact lower/upper till
Resembles other Duncan Creek samples (ilmenite, minor magnetite); noted 1 small bright scarlet red grain (unidentified).

Taylor Pay Unit near Bedrock Duncan Creek
Sample contains mainly rock fragments (40-70%) and ilmenite (30-50%). A total of four gold grains were noted; three small rounded grains 0.2 mm and one larger subrounded, irregular shaped elongated grain 1.2 mm. Sample also contained 2-5% euhedral, lustrous pyrite.

DC1-95-1 Duncan Creek 40 Pup Bench Duncan Unit 1

Ilmenite, trace goethite/hematite psuedomorphs after pyrite.

DC1-95-2 Duncan Creek 40 Pup Bench Duncan Unit 2

Very low yield.

HB2-95-1 Upper Duncan Creek Barchans old cut – multiple tills

Very interesting sample. Mainly ilmenite and magnetite, but also get pyrite and an unidentified grey sulphide mineral.

HB2-95-2 Upper Duncan Creek Barchans old cut – multiple tills

Varied mix of minerals and rocks. Garnet, ilmenite, rock fragments.

HB2-95-3 Upper Duncan Creek Barchans old cut – multiple tills

Mix of minerals and rock fragments. Same as HB2-95-2.

HB4-95-1 Upper Duncan Creek Upper Duncan Canyon Section Gravel

Contains 2-3% pyrite, 20-50% ilmenite.

UD971-01 Pay Gravel – (vial a) Section UD971 Upper Duncan Creek

Garnetiferous (35-45%) with ilmenite (30-40%) and magnetite (10-20%). Moderate limonite coating on most grains.

UD971-01 Pay Gravel – (vial b) Section UD971 Upper Duncan Creek

Well-rounded grains with thick brownish yellow limonitic coating. Mainly schistose rock fragments (60-80%). Sample contains two rounded gold grains, 0.3 to 0.5 mm.

UD971-02 Section UD971 Upper Duncan Creek

Sample is composed mainly of schistose rock fragments (50-60%), ilmenite (15-30%) and goethite replacements after pyrite (10-20%). Sample contains one grain of scheelite (1.5 mm).

UD971-05 Section UD971 Upper Duncan Creek

Mainly ilmenite (30-40%), rock fragments (20-30%) and garnet (20-30%).

UD973-03 Section UD9703 Upper Duncan Creek

Hematite/Goethite replacements after pyrite (25-45%) and schistose rock fragments (30-50%).

FH-9619-01 Section FH9619 Thunder Gulch

Very low yield of heavy minerals; mainly rock fragments (40-60%). Lustrous pyrite cubes 2-5%.

FH-9619-02 Section FH9619 Thunder Gulch

Sample consists mainly of magnetite (20-30%), ilmenite (25-35%) and rock fragments (10-20%). Also, 5-10% granular to crystalline white translucent crystals (zoisite?).

FH-9619-04 Section FH9619 Thunder Gulch

Mineral grains in the sample are coated with limonite. Sample consists mainly of rock fragments (50-70%).

FH-9619-05 Section FH9619 Thunder Gulch

Sample consists mainly of rock fragments (35-55%), magnetite (20-30%), ilmenite (15-25%), oxidized cubic pyrite (5-10%) and possible white zoisite (3-5%).

FH-9619-02-08 Section FH9619-02 Thunder Gulch

Sample consists mainly of rock fragments (30-50%) and ilmenite (30-50%).

FE1-95-1 Highet Creek F. Erl Unit 1 – Orange gravel

Ilmenite-rich. Mineral grains are coated with limonite.

FE1-95-2 Highet Creek F. Erl Unit 2 – Organic silt

Sample is composed of mostly tabular ilmenite grains.

FE1-95-3 Highet Creek F. Erl Unit 3

Sample is 80-95% ilmenite.

HT3-95-1 Highet Creek Highet Creek band section near old cabin

Mainly ilmenite and magnetite. There are five subrounded to rounded flattened gold grains; the largest is 0.06 mm.

KK1-95-1 Highet Creek Highet Creek Klippert Unit 1

There are 20 gold grains (about 1% of sample). The largest gold grain is 1 mm and very flat. The gold grains are subcrystalline to subrounded. There are 25 grains scheelite (about 1% of sample). The sample is mainly composed of ilmenite (90-95%). Approximately 10% of the ilmenite is coated by leucoxene.

KK1-95-2B Highet Creek Highet Creek Klippert Unit 2

Almost 100% tabular ilmenite.

KK1-95-3 Highet Creek Highet Creek Klippert Unit 3

Mainly ilmenite, trace oxidized pyritohedrons.

MP1-95-1 Highet Creek Merrill Powers Pit Unit 1 clay/bedrock

Mostly limonite coated rock fragments.

MP1-95-2 Highet Creek Merrill Powers Pit Unit 2 – Pay gravel

Gold grains comprise 5-15% of the sample; the largest grain is 2 mm. Most of the gold grains are flat and rounded; some are subrounded. One scheelite grain and small zircon grains are visible under ultraviolet light. Schistose rock fragments comprise 10-20% of the sample.

WL96-02 Highet Creek

Most grains have a brown coating. Sample is mainly ilmenite (60-80%). There is one subcrystalline gold grain 0.2 mm. Sample contains up to 1% zircon.

RUD9701-01 Section RUD9701 Rudolph Gulch

Almost entirely ilmenite (95-98%). Ilmenite grains are angular, 0.25 to 1.0 mm. Sample also contains scheelite (1-3%) and three rounded gold grains 0.3 to 0.5 mm.

RUD9701-02 Section RUD9701 Rudolph Gulch

Same as RUD-97-01-01. Almost entirely ilmenite (95-98%), with trace to 1% scheelite. Sample also contains 1 mass of yellow gold 1.0 mm with leafy to subcrystalline form and a smaller crystalline gold piece 0.3 mm.

RUD9701-03 Section RUD9701 Rudolph Gulch
Same as RUD-97-01-01 and RUD-97-01-02. Ilmenite-rich (95-98%). Also contains scheelite (1-2%).

MIC9701-04 Section MIC9701 McIntyre Creek
Mainly ilmenite (60-70%) with minor garnet. Some brass shavings in the sample.

MIC9701-05 Section MIC9701 McIntyre Creek
Similar to MIC-97-01-04.

MIC9702-01 Section MIC9702 McIntyre Creek
Mainly rock fragments (50-70%), ilmenite (20-30%) and garnet (10-25%). Contains trace scheelite and 5-10% staurolite.

MIC9704-01 Section MIC9704 McIntyre Creek
Heavy limonitic coating over most grains. Mainly rock fragments (50-70%). Lustrous pyrite cubes (2-3%).

MIC9704-02 Section MIC9704 McIntyre Creek
Mainly ilmenite with garnet. One rounded gold grain 0.8 mm and one smaller subcrystalline grain 0.4 mm noted.

MIC9705-01 Section MIC9705 McIntyre Creek
Sample is mainly ilmenite, rock fragments, garnet and magnetite. One rounded gold grain 0.3 mm. Trace amounts of scheelite.

MIC9706-01 Section MIC9706 McIntyre Creek
Mainly ilmenite (30-40%) with magnetite (15-25%). Also garnet, rock fragments, and goethite pseudomorphs after pyrite. Ilmenite grains are coated with leucoxene. Other grains are lightly coated with limonite. There are three rounded gold grains, 0.3 mm to 0.7 mm and trace amounts of scheelite. One grain sillimanite.

MIC9708-01 Section MIC9707 McIntyre Creek
Mainly ilmenite (25-50%) and rock fragments (25-50%). Also get lustrous pyrite cubes (tr to 1%) averaging 0.5 mm in addition to goethite pseudomorphs after pyrite (5-10%). There are four rounded gold grains about 0.4 mm. Scheelite is present in trace amounts.

MIC9709-07 Section MIC9709 McIntyre Creek
Resembles MIC-97-08-01, but has more pyrite. Sample is mainly ilmenite (15-25%), rock fragments (15-25%) and garnet (15-25%). Lustrous pyrite cubes (10%) and slightly oxidized pyrite (10-15%) are present in addition to goethite pseudomorphs after pyrite (5-10%).

MIC9710-02 Section MIC9710 McIntyre Creek
Sample contains mainly ilmenite (40-60%), rock fragments (30-40%), garnet (10-20%) and magnetite (10-15%). Trace amounts of lustrous pyrite.

MIC9710-06 Section MIC9710 McIntyre Creek
Sample contains mainly rock fragments (30-60%), ilmenite (20-40%), garnet (10-20%) and magnetite (5-10%).

MLN9701-01 Section MLN9701 McLagan Creek
Mainly magnetite (35-45%) and rock fragments (25-45%). Bronze artifact.

MLN9702-01 Section MLN9702 McLagan Creek
Mainly ilmenite (35-45%), magnetite (25-35%) and rock fragments (15-25%). Bronze and silvery metallic artifacts.

DK1-94-1A Seattle Creek Dan Klipperts Pay Sample
Gold grains are up to 1.2 mm and are sub-rounded.

DK1-94-1B Seattle Creek Dan Klipperts Pay Sample
Mostly rock fragments and ilmenite.

DK1-95-1 Seattle Rusty gravel Unit 1
Abundant rock fragments; mainly mafic schist. Sample is black and yellow and exhibits a "salt and pepper" look. One grain is intense white-green under longwave and moderate under shortwave. In visible light, the grain is white, platy, friable (brucite?, talc?).

SEA9701-01 Section SEA9701 Seattle Creek
Mainly ilmenite (40-50%) and rock fragments (40-50%). Sample also contains lustrous cubic pyrite (2-3%).

SEA9701-02 Section SEA9701 Seattle Creek
Ilmenite (50-70%) and rock fragments (30-50%) are the main constituents. Also get one subhedral 0.2 mm gold grain, 10 grains of scheelite and several shavings of brass and another metallic artifact. This sample contains scheelite (trace) and fewer lustrous pyrite cubes than in SEA-97-01-01.

SEA9701-03 Section SEA9701 Seattle Creek
Sample contains mainly ilmenite (70-90%) and rock fragments (10-20%), with 10 grains scheelite (<tr). Artificial artifacts (shavings).

SEA9703-02 Section SEA9703 Seattle Creek
Mainly ilmenite (70-85%) and magnetite (20-30%). There are three rounded grains of gold; one is 1.0 mm, and the other two are 0.4 to 0.5 mm. Trace amounts of scheelite was noted.

SEA9705-02 Section SEA9705 Seattle Creek
Mainly ilmenite (75-90%). One rounded gold grain 1.0 mm and trace amounts of scheelite.

BEAR9702-01 Section BEAR9702 Upper Bear Creek
Mainly rock fragments (25-35%), magnetite (20-30%) and ilmenite (15-25%). One grain of scheelite was noted and one rounded grain gold 0.4 mm.

Goodman Creek Unit 1 Section Goodman Cr. Goodman Creek
Sample contains magnetite (20-40%) and schistose rock fragments (30-50%). Lustrous cubic pyrite (tr-1%).

Goodman Creek Unit 2 Section Goodman Cr. Goodman Creek
Sample contains magnetite (30-40%), ilmenite (20-30%) and rock fragments (20-30%). Sample contains two grains of scheelite.

Goodman Creek Unit 3 Section Goodman Cr. Goodman Creek
Sample contains magnetite (20-30%) and trace amounts of scheelite. Also contains unidentified lustrous, euhedral greenish mineral (pyroxene?).

ROD-97-01-01 Section ROD971 Rodin Creek
Very well sorted grains, average 0.2 mm. Mainly ilmenite (40-50%), granite and schistose rock fragments (10-25%), and magnetite (10-20%).

ROD-97-01-02 Section ROD971 Rodin Creek
Sample contains 40-60% ilmenite. Sample is well-sorted. Very similar to ROD-97-01-01.

ROD-97-01-03 Section ROD971 Rodin Creek
Very similar to ROD-97-01-03 and ROD-97-01-04. Sample contains ilmenite (50-60%), rock fragments (10-20%) and magnetite (10-20%).

ROD-97-01-04 Section ROD971 Rodin Creek
Sample contains ilmenite (40-50%), rock fragments (20-30%) and magnetite (5-15%) in addition to two rounded gold grains 1.7 mm and 0.5 mm. Very similar to ROD-97-01-01,02,03.

AC9701-01 Section AC9701 Andersen Creek
Sample consists mainly of magnetite (40-60%) and ilmenite (25-40%).

AC9701-03 Section AC9701 Andersen Creek
Mainly mica-ilmenite schist rock fragments (20-35%), ilmenite (25-35%) and magnetite (10-25%).

RB1-95-1B Ledge Ledge Creek sediment sample
The sample size was very small. No magnetite was recovered. Most of the grains are rock fragments; mainly mafic schist. One 0.03 mm scheelite grain was visible under ultraviolet light. There is one brownish yellow transparent to translucent twinned crystal (unidentified).

LDG9701-01 Section LDG9701 Ledge Creek
Sample contains mainly ilmenite (50-70%) and rock fragments (20-40%). One rounded gold grain 0.3 mm was noted.

LDG9702-01 Section LDG9702 Ledge Creek
Mainly ilmenite (40-60%) and rock fragments (35-40%). Two gold grains were noted; one rounded 0.3 mm and one crystalline, euhedral grain 0.4 mm. Trace amounts of scheelite were noted.

LDG9703-01 Section LDG9703 Ledge Creek
Sample consists mainly of ilmenite-bearing schistose rock fragments (60-80%) and ilmenite (20-30%). Sample contains trace amounts of scheelite.

DVD9701-01 Section DVD9701 Davidson Creek
Sample is mainly magnetite (45-55%) and ilmenite (40-50%). One rounded gold grain 0.3 mm was noted.

DVD9702-01 Section DVD9702 Davidson Creek
Sample is mainly ilmenite (40-60%) and magnetite (20-30%). Three rounded 0.3 mm grains of gold were noted. One scheelite grain was noted.

DVD9703 DVD9703 Davidson Creek
Sample is mainly magnetite (40-60%) and ilmenite (25-35%). Three subrounded grains of gold 0.2 to 0.4 mm were noted.

DVD9703-03 DVD9703 Davidson Creek
Sample is mainly magnetite (60-70%) and ilmenite (20-30%).

Davidson Creek Pay Unit Blue Clay
Sample contains ilmenite (25-35%), magnetite (25-35%) and lustrous cubic pyrite (5-10%).

LW-97-01(a) Unit 1 Haggart Creek
Interesting sample; contains almost 100% sulphide fragments consisting of 50% pyrite and 50% arsenopyrite. About 50% of the sulphide fragments are pyrite, and the other half are arsenopyrite. At least ten grains of irregular to flattened subrounded gold were noted. Sulphide grains are euhedral and range up to 3 mm in size.

LW-97-01(b) Unit 1 Haggart Creek
Pyritiferous sample (euhedral pyrite up to 50%). Up to 1% of the pyrite grains are coated with copper staining (Cu, Pb). Grains in the sample are coated with limonite. Trace amounts of arsenopyrite noted.

LW-97-04 Unit 1 Haggart Creek
Pyritiferous sample (70-90% pyrite). Arsenopyrite (<1%) was noted in addition to boulangerite (trace), malachite (mal) and scheelite (<<tr).

LW-97-05 Unit 1 Haggart Creek
Rock grains are thickly coated with limonite, sample contains mainly of rock fragments (40-60%). Very minor scheelite noted.

LW-97-15 Unit 4 Haggart Creek
Mainly ilmenite (40-60%) and rock fragments (2-3%). Scheelite content is 2-3%. Contains 2-3% lustrous, untarnished pyrite fragments.

LW-97-26 Unit 1 Haggart Creek
Almost entire rock fragments (90-95%). Scheelite content is 1%.

LW-97-27 Unit 1 Haggart Creek
Sample is almost 100% sulphides. Pyrite content is 30-50%. Contains 30-50% arsenopyrite, 1-2% scheelite and 1% cassiterite.

LW-97-20 Base of Unit 1 Dublin Gulch
Sample contains mainly scheelite (55-65%) and rock fragments (25-35%). Zircon content is 2-3%.

Dublin Gulch LW-97-21 Unit 1
Interesting sample. Sample is mainly 55-60% scheelite and contains abundant (7-15%) rutile. There are seven grains of gold 0.2 to 0.6 mm; six pieces are crystalline gold, some in quartz, and the other is subrounded gold in quartz. The gold is very fresh, appears to have weathered from a nearby source. One fragment of arsenopyrite was noted.

LW-97-22 Unit 1 Dublin Gulch
Sample is mainly schistose rock fragments (75-95%). Minor scheelite (<tr) was noted.

LW-97-22 Unit 2 Dublin Gulch
Sulphide-rich sample. Contains 25-30% pyrite, 5-15% arsenopyrite, 1% boulangerite (acicular, metallic grey) and 2-5% siderite.

LW-97-09 Unit 1 Gill Gulch
Sample consists mainly of rock fragments (60-90%) and scheelite (5-15%). Contains manganese garnets of andradite-spessartine composition.

LW-97-10 Unit 1 Gill Gulch
Grains in sample have a thin limonitic coating. Mainly rock fragments (80-90%) and scheelite (5-10%).

LW-97-12 Unit 1 Gill Gulch
Interesting sample. Mainly rock fragments (60-90%). Also contains one grain bright yellow subcrystalline gold, 0.4 mm. Contains 1% anatase, trace crystalline cassiterite and one corundum crystal. The corundum crystal has six-sided columnar form, subadamantine lustre, light grey colour. Rutile content is 2-5%.

LW-97-14 Unit 1 Gill Gulch
Mainly rock fragments (60-80%), ilmenite (5-15%) and scheelite (5-10%). Contains 1-2% massive limonitic fragments.

Gill 4 Unit 1 Gill Gulch
Sample consists mainly of goethite pseudomorphs after pyrite (50-60%). Sample also contains scheelite (5-15%).

LW-97-16 Unit 1 (a) Fisher Gulch
Sample consists of schistose rock fragments (50-80%). Sample contains 2-5% orange-brown euhedral cassiterite and black massive goethite with radiating habit.

LW-97-17 Unit 1 (b) Fisher Gulch
Grains in sample are coated with limonite. Sample contains 3-5% euhedral yellowish-brown, lustrous cassiterite and 3-5% massive reddish brown goethite. Sample consists mainly of schistose rock fragments (80-90%).

Appendix 3. Trace element geochemistry

ICP-AES Detection limits for gold and 32 elements

Element	Range
Aluminum (Al)	0.01 – 15%
Antimony (Sb)	2 ppm – 1%
Arsenic (As)	2 ppm – 1%
Barium (Ba)	10 ppm – 1%
Beryllium (Be)	0.5 – 100 ppm
Bismuth (Bi)	2ppm – 1%
Cadmium (Cd)	0.2 – 100 ppm
Calcium (Ca)	0.01 – 15%
Chromium (Cr)	1 ppm – 1%
Cobalt (Co)	1 ppm – 1%
Copper (Cu)	1 ppm – 1%
Gallium (Ga)	10 ppm – 1%
Gold (Au)	5 – 10 000 ppb
Iron (Fe)	0.01 – 15%
Lanthanum (La)	10 ppm – 1%
Lead (Pb)	2 ppm – 1%
Magnesium (Mg)	0.01 – 15%
Manganese (Mn)	5 ppm – 1%
Mercury (Hg)	1 ppm – 1%
Molybdenum (Mb)	1 ppm – 1%
Nickel (Ni)	1 ppm – 1%
Phosphorus (P)	10 ppm – 1%
Potassium (K)	0.1 – 10%
Scandium (Sc)	1 ppm – 1%
Silver (Ag)	0.2 – 100 ppm
Sodium (Na)	0.01 – 10%
Strontium (Sr)	1 ppm – 1%
Thallium (Tl)	10 ppm – 1%
Titanium (Ti)	0.01 – 10%
Tungsten (W)	10 ppm – 1%
Uranium (U)	10 ppm – 1%
Vanadium (V)	1 ppm – 1%
Zinc (Zn)	2 ppm – 1%

Stream	Sample number	Location UTM	Au ppb	Ag ppb	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm
Secret Creek	JB96-05	450500 E 7094900 N	20	1	1	12	130	< 0.5	< 2	0	< 0.5	7	13	14	2	< 10	< 1
Right fork of Secret Creek	JB96-06	450600 E 7094950 N	<5	< 0.2	1	36	150	< 0.5	< 2	0	< 0.5	11	15	21	2	< 10	< 1
Right fork of Ironrust Creek	JB96-07	457300 E 7104100 N	<5	< 0.2	1	12	210	< 0.5	< 2	0	< 0.5	11	14	14	2	< 10	1
Ironrust Creek	JB96-08	457200 E 7103950 N	<5	< 0.2	1	16	230	< 0.5	< 2	0	1	16	13	19	3	< 10	< 1
Fisher Creek	JB96-10	457500 E 7101600 N	<5	< 0.2	1	34	130	< 0.5	< 2	0	< 0.5	10	14	22	2	< 10	< 1
Ray Gulch	JB96-19	464750 E 7099100 N	<5	< 0.2	2	232	180	< 0.5	< 2	1	< 0.5	13	27	24	3	< 10	< 1
No name tributary to Lynx Creek	JB96-20	462700 E 7098000 N	<5	< 0.2	2	192	380	< 0.5	< 2	0	< 0.5	22	27	22	3	< 10	< 1
No name tributary to Lynx Creek	JB96-21	464250 E 7098700 N	30	< 0.2	2	188	190	< 0.5	< 2	1	< 0.5	12	25	19	3	< 10	< 1
MacNeil Creek	JB96-22	492800 E 7087300 N	65	0	1	54	90	< 0.5	< 2	0	< 0.5	5	11	17	1	< 10	< 1
Parent Creek	JB96-23	480750 E 7078300 N	<5	< 0.2	1	8	280	< 0.5	< 2	0	2	30	15	25	3	< 10	< 1
Parent Creek	JB69-24	479400 E 7078400 N	<5	< 0.2	1	6	190	< 0.5	< 2	0	3	31	13	26	2	< 10	< 1
No name tributary to Eagle Creek	JB96-25	468250 E 7121100 N	<5	< 0.2	1	6	660	< 0.5	< 2	0	< 0.5	13	18	39	3	< 10	< 1
No name tributary to Eagle Creek	JB96-26	468000 E 7120200 N	<5	< 0.2	1	4	1040	< 0.5	< 2	0	< 0.5	16	13	64	3	< 10	< 1
No name tributary to Steamboat Lake	JB96-29	468300 E 7115350 N	<5	< 0.2	1	6	200	< 0.5	< 2	0	< 0.5	12	16	29	3	< 10	< 1
No name tributary to Steamboat Lake	JB96-30	469500 E 7116500 N	<5	< 0.2	1	2	310	< 0.5	< 2	1	< 0.5	13	21	32	3	< 10	< 1
No name tributary to Steamboat Lake	JB96-31	469850 E 7117800 N	<5	< 0.2	1	4	380	< 0.5	< 2	1	< 0.5	12	21	29	3	< 10	1
No name tributary to Eagle Creek	JB96-32	464750 E 7120650 N	<5	< 0.2	1	4	460	< 0.5	< 2	0	1	16	17	24	3	< 10	< 1
No name tributary to Eagle Creek	JB96-33	465000 E 7120000N	<5	< 0.2	1	2	490	< 0.5	< 2	0	< 0.5	6	13	10	2	< 10	< 1
No name tributary to Upper Duncan	JB96-34	488450 E 7120000 N	<5	< 0.2	1	8	160	< 0.5	< 2	0	< 0.5	8	13	21	2	< 10	< 1
No name tributary to Upper Duncan	JB96-35	487350 E 7081850 N	<5	< 0.2	1	10	170	< 0.5	< 2	0	2	8	14	26	2	< 10	< 1
Forty Pup	JB96-38	483600 E 7081100 N	<5	< 0.2	1	10	120	< 0.5	< 2	0	< 0.5	9	15	16	3	< 10	< 1
Forty Pup	JB96-39	482800 E 7081900 N	<5	< 0.2	1	10	100	< 0.5	< 2	0	< 0.5	8	12	12	2	< 10	< 1
Forty Pup	JB96-40	481200 E 7082700 N	<5	< 0.2	1	10	110	< 0.5	< 2	0	< 0.5	9	13	16	2	< 10	< 1
Lynx Creek	JB96-41	461200 E 7097150 N	20	< 0.2	1	60	190	< 0.5	< 2	0	1	10	17	15	2	< 10	< 1
Lynx Creek	JB96-42	459850 E 7096250 N	<5	< 0.2	1	58	180	< 0.5	< 2	0	1	9	17	15	2	< 10	< 1
Haggart Creek	JB96-43	458000 E 7096200 N	45	< 0.2	1	74	190	< 0.5	< 2	0	< 0.5	10	16	20	2	< 10	< 1
No name tributary to Keystone Creek	JB96-44	491750 E 7077200 N	<5	< 0.2	1	72	70	< 0.5	< 2	0	< 0.5	10	11	19	3	< 10	< 1
No name tributary to Keystone Creek	JB96-45	493950 E 7078500 N	<5	1	1	52	230	< 0.5	< 2	0	1	14	20	31	3	< 10	< 1
No name tributary to Keystone Creek	JB96-46	494000 E 7078250 N	<5	< 0.2	1	28	100	< 0.5	< 2	0	< 0.5	13	24	31	3	< 10	< 1
No name tributary to Granite Creek	JB96-47	497200 E 7079300 N	25	0	2	36	320	< 0.5	< 2	0	2	22	33	39	3	< 10	< 1
Upper Granite Creek	JB96-48	496750 E 7080700 N	20	1	1	128	150	< 0.5	< 2	0	1	11	25	34	3	< 10	< 1
No name tributary to Keystone Creek	JB96-49	490900 E 7076200 N	10	< 0.2	1	46	260	< 0.5	< 2	0	2	11	13	28	3	< 10	< 1
Red Creek	JB96-51	443750 E 7094050 N	<5	< 0.2	1	12	180	< 0.5	< 2	0	2	21	13	16	3	< 10	< 1
No name tributary to Red Creek	JB96-52	438500 E 7092700 N	<5	< 0.2	1	10	190	< 0.5	< 2	0	< 0.5	9	16	15	2	< 10	< 1
Faro Gulch	JB96-53	492200 E 7092650 N	235	66	1	534	120	< 0.5	< 2	0	10	16	12	114	4	< 10	< 1
No name tributary to Corkery Creek	JB96-54	470800 E 7081150 N	55	0	1	1190	530	< 0.5	< 2	1	< 0.5	14	27	15	4	< 10	< 1
No name tributary to Corkery Creek	JB96-55	470750 E 7080600 N	15	< 0.2	2	108	530	< 0.5	< 2	1	< 0.5	18	34	30	5	< 10	< 1
Edmonton Creek	JB96-56	509000 E 7071000 N	80	< 0.2	1	12	140	< 0.5	< 2	0	1	19	19	28	3	< 10	< 1
No name tributary to Mayo Lake	JB96-57	494300 E 7072800 N	<5	< 0.2	1	10	100	< 0.5	< 2	0	< 0.5	6	13	13	2	< 10	< 1
Keystone Creek	JB96-58	489750 E 7073700 N	<5	< 0.2	1	28	160	< 0.5	< 2	0	< 0.5	7	14	18	2	< 10	< 1
Silver Basin Gulch	JB96-60	492150 E 7092650 N	20	1	1	98	200	< 0.5	< 2	0	3	18	15	78	3	< 10	< 1
Right fork of Upper Red Creek	JB96-61	447600 E 7106800 N	15	< 0.2	1	2	140	< 0.5	< 2	0	< 0.5	13	13	14	2	< 10	< 1
Left fork of Upper Red Creek	JB96-62	447300 E 7106800 N	<5	< 0.2	1	< 2	200	< 0.5	< 2	0	< 0.5	12	16	16	2	< 10	< 1
Red Creek	JB96-63	444800 E 7101850 N	<5	< 0.2	1	2	170	< 0.5	< 2	0	< 0.5	13	15	17	3	< 10	< 1

Stream	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
Secret Creek	0	30	0	250	< 1	< 0.01	16	510	18	2	1	22	0	< 10	< 10	20	< 10	72
Right fork of Secret Creek	0	30	0	395	1	< 0.01	21	570	28'	2	2	24	0	< 10	< 10	23	< 10	84
Right fork of Ironrust Creek	0	20	0	370	1	< 0.01	21	560	10	< 2	2	29	0	< 10	< 10	24	< 10	62
Ironrust Creek	0	20	0	1385	1	< 0.01	29	480	26	< 2	1	17	0	< 10	< 10	23	< 10	128
Fisher Creek	0	30	0	400	1	< 0.01	18	430	30	2	1	18	0	< 10	< 10	20	< 10	78
Ray Gulch	0	20	1	420	2	< 0.01	26	580	12	< 2	4	47	0	< 10	< 10	41	10	84
No name tributary to Lynx Creek	0	30	1	1440	2	< 0.01	25	520	8	< 2	4	37	0	< 10	< 10	44	< 10	94
No name tributary to Lynx Creek	0	20	1	325	3	< 0.01	22	630	10	< 2	4	45	0	< 10	< 10	37	10	76
MacNeil Creek	0	10	0	275	1	< 0.01	13	370	16	< 2	1	9	0	< 10	< 10	16	< 10	54
Parent Creek	0	30	0	555	1	< 0.01	41	600	14	< 2	1	25	0	< 10	< 10	23	< 10	262
Parent Creek	0	30	0	695	1	< 0.01	65	550	10	< 2	1	25	0	< 10	< 10	19	< 10	320
No name tributary to Eagle Creek	0	30	0	545	1	< 0.01	32	540	16	< 2	1	52	0	< 10	10	20	< 10	108
No name tributary to Eagle Creek	0	20	0	1140	3	< 0.01	39	540	16	< 2	1	55	< 0.01	< 10	< 10	16	< 10	106
No name tributary to Steamboat Lake	0	30	1	1020	1	< 0.01	26	610	12	< 2	1	37	0	< 10	< 10	24	< 10	76
No name tributary to Steamboat Lake	0	30	1	605	1	< 0.01	29	670	12	< 2	3	61	0	< 10	< 10	28	< 10	98
No name tributary to Steamboat Lake	0	20	1	460	2	< 0.01	31	670	10	< 2	2	60	0	< 10	< 10	30	< 10	98
No name tributary to Eagle Creek	0	10	0	555	1	< 0.01	47	620	14	< 2	1	35	< 0.01	< 10	< 10	19	< 10	160
No name tributary to Eagle Creek	0	10	0	445	1	< 0.01	16	1090	6	< 2	1	28	0	< 10	< 10	20	< 10	60
No name tributary to Upper Duncan	0	20	0	565	1	< 0.01	18	500	10	< 2	1	15	0	< 10	< 10	21	< 10	60
No name tributary to Upper Duncan	0	30	0	485	3	< 0.01	42	630	16	< 2	1	26	0	< 10	< 10	22	< 10	194
Forty Pup	0	30	0	455	1	< 0.01	21	540	14	< 2	1	22	0	< 10	< 10	21	< 10	100
Forty Pup	0	20	0	365	< 1	< 0.01	16	420	12	44	1	20	0	< 10	< 10	16	< 10	58
Forty Pup	0	30	0	265	1	< 0.01	17	720	12	8	1	28	0	< 10	< 10	21	< 10	66
Lynx Creek	0	20	0	595	2	0	20	730	14	< 2	2	33	0	< 10	< 10	27	< 10	96
Lynx Creek	0	10	0	530	1	0	19	710	12	< 2	2	29	0	< 10	< 10	26	< 10	90
Haggart Creek	0	20	0	525	1	< 0.01	21	570	28	6	1	27	0	< 10	< 10	23	< 10	80
No name tributary to Keystone Creek	0	30	1	425	1	< 0.01	20	520	14	2	1	37	0	< 10	< 10	11	< 10	72
No name tributary to Keystone Creek	0	10	0	510	2	< 0.01	67	650	14	< 2	1	17	0	< 10	< 10	21	< 10	176
No name tributary to Keystone Creek	0	30	1	460	1	< 0.01	46	640	16	< 2	2	22	0	< 10	< 10	19	< 10	118
No name tributary to Granite Creek	0	10	0	670	2	< 0.01	39	800	16	< 2	3	22	0	< 10	< 10	42	< 10	164
Upper Granite Creek	0	10	0	415	3	< 0.01	33	1000	26	< 2	3	24	0	< 10	< 10	34	< 10	124
No name tributary to Keystone Creek	0	40	0	445	3	< 0.01	54	590	16	10	1	27	< 0.01	< 10	< 10	22	< 10	226
Red Creek	0	20	0	825	1	< 0.01	36	420	18	2	1	24	0	< 10	< 10	22	< 10	164
No name tributary to Red Creek	0	40	0	780	1	< 0.01	21	540	18	< 2	1	30	0	< 10	< 10	23	< 10	78
Faro Gulch	0	10	0	2620	7	< 0.01	32	1220	>10 000	74	1	29	0	< 10	< 10	16	< 10	818
No name tributary to Corkery Creek	0	20	1	2660	1	< 0.01	25	770	34	6	3	62	0	< 10	< 10	32	< 10	114
No name tributary to Corkery Creek	0	20	1	1275	1	< 0.01	36	690	22	4	4	82	0	< 10	< 10	38	< 10	118
Edmonton Creek	0	30	0	325	1	< 0.01	38	560	6	< 2	1	18	0	< 10	< 10	34	< 10	160
No name tributary to Mayo Lake	0	10	0	240	1	< 0.01	14	490	8	< 2	1	18	0	< 10	< 10	19	< 10	46
Keystone Creek	0	30	0	290	1	< 0.01	22	570	10	8	1	21	0	< 10	< 10	18	< 10	92
Silver Basin Gulch	0	10	1	1645	5	< 0.01	42	870	94	2	1	26	< 0.01	< 10	< 10	17	< 10	302
Right fork of Upper Red Creek	0	40	0	285	1	< 0.01	23	480	12	< 2	1	24	0	< 10	< 10	22	< 10	96
Left fork of Upper Red Creek	0	30	0	415	1	< 0.01	19	490	14	< 2	1	31	0	< 10	< 10	24	< 10	72
Red Creek	0	30	0	285	1	< 0.01	20	410	14	< 2	1	29	0	< 10	< 10	19	< 10	78

Stream	Sample number	Location UTM	Au ppb	Ag ppb	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm
Fisher Creek	JB96-65	444800 E 7124250 N	<5	< 0.2	1	4	800	< 0.5	< 2	0	< 0.5	11	19	38	3	< 10	< 1
Fisher Creek	JB96-66	443150 E 7122250 N	<5	< 0.2	1	2	560	< 0.5	< 2	1	1	11	15	27	3	< 10	< 1
Sluice Creek	JB96-67	449600 E 7116200 N	<5	< 0.2	1	10	2140	< 0.5	< 2	0	1	12	14	42	3	< 10	< 1
Sluice Creek	JB96-68	447800 E 7114900 N	<5	< 0.2	1	6	2890	< 0.5	< 2	0	1	9	14	37	3	< 10	< 1
No name tributary to Ballard Creek	JB96-69	427100 E 7099600 N	<5	< 0.2	1	2	250	< 0.5	< 2	1	< 0.5	7	17	14	2	< 10	< 1
Ballard Creek	JB96-70	426800 E 7099800 N	<5	< 0.2	1	< 2	320	< 0.5	< 2	0	< 0.5	9	18	14	2	< 10	< 1
No name tributary to the E. McQuesten River	JB96-71	433900 E 7106750 N	<5	< 0.2	1	< 2	260	< 0.5	< 2	0	< 0.5	8	15	15	2	< 10	< 1
No name tributary to the E. McQuesten River	JB96-72	437900 E 7105500 N	<5	< 0.2	1	< 2	240	< 0.5	< 2	1	< 0.5	8	17	16	2	< 10	1
Larsen Creek	JB96-73	428900 E 7111250 N	<5	< 0.2	1	4	260	< 0.5	< 2	0	< 0.5	10	16	18	2	< 10	< 1
No name tributary to the E. McQuesten River	JB96-74	438000 E 7113500 N	<5	< 0.2	1	2	270	< 0.5	< 2	1	< 0.5	9	18	13	2	< 10	1
No name tributary to the E. McQuesten River	JB96-75	437900 E 7113750 N	<5	< 0.2	1	< 2	160	< 0.5	< 2	0	< 0.5	8	16	14	2	< 10	< 1
No name tributary to the E. McQuesten River	JB96-76	433850 E 7125000 N	25	< 0.2	1	< 2	180	1	< 2	0	< 0.5	9	18	19	3	< 10	< 1
No name tributary to the E. McQuesten River	JB96-77	433800 E 7124750 N	<5	< 0.2	1	4	190	< 0.5	< 2	0	< 0.5	9	18	15	2	< 10	< 1
No name tributary to the E. McQuesten River	JB96-78	442450 E 7117400 N	<5	< 0.2	1	< 2	190	< 0.5	< 2	0	< 0.5	8	17	14	2	< 10	< 1
No name tributary to the E. McQuesten River	JB96-79	453250 E 7121150 N	<5	0	2	10	2690	< 0.5	< 2	1	4	12	15	60	3	< 10	< 1
No name tributary to Sluice Creek	JB96-80	452950 E 7121250 N	<5	< 0.2	1	6	3610	< 0.5	< 2	0	1	13	16	37	2	< 10	< 1
Davidson Creek	JB96-81	469000 E 7067000 N	<5	< 0.2	0	4	80	< 0.5	< 2	1	< 0.5	5	7	8	1	< 10	< 1
Christie Creek	JB96-82	453750 E 7109000 N	<5	< 0.2	1	2	150	< 0.5	< 2	0	< 0.5	9	13	16	2	< 10	< 1
No name tributary to Christie Creek	JB96-83	453659 E 7108900 N	<5	< 0.2	1	14	280	1	< 2	0	< 0.5	30	16	21	4	< 10	< 1
No name tributary to the E. McQuesten River	JB96-84	460500 E 7112200 N	<5	< 0.2	1	2	90	< 0.5	< 2	0	< 0.5	10	14	18	3	< 10	< 1
Lime Creek	JB96-85	469900 E 7109500 N	<5	< 0.2	1	8	210	< 0.5	< 2	1	< 0.5	10	16	19	2	< 10	< 1
Skate Creek	JB96-86	469000 E 7099400 N	<5	< 0.2	1	110	260	< 0.5	< 2	1	< 0.5	10	23	21	2	< 10	< 1
McKim Creek	JB96-87	505000 E 7088000 N	<5	< 0.2	1	10	290	< 0.5	< 2	1	1	7	15	17	2	< 10	< 1
No name tributary to Roop Creek	JB96-88	525000 E 7082000 N	<5	< 0.2	1	4	610	< 0.5	< 2	0	< 0.5	6	12	15	2	< 10	< 1
Granite Creek	JB96-89	509000 E 7080000 N	<5	< 0.2	1	8	240	< 0.5	< 2	0	< 0.5	5	14	51	1	< 10	< 1
Hope Gulch	JB96-90	490250 E 7087850 N	200	45	1	620	130	< 0.5	< 2	1	46	12	14	84	4	< 10	< 1
Lightning Creek	JB96-91	487800 E 7087100 N	120	22	1	328	180	< 0.5	< 2	0	19	10	16	55	3	< 10	< 1
Bear Creek	JB96-92	433212 E 7062852 N	<5	< 0.2	1	8	120	< 0.5	< 2	0	< 0.5	6	9	15	2	< 10	< 1
Williams Creek	JB96-93	475750 E 7079900 N	10	< 0.2	1	28	270	< 0.5	< 2	0	< 0.5	7	16	28	2	< 10	< 1
Empire Creek	JB96-94	470000 E 7038000 N	<5	< 0.2	1	4	200	< 0.5	< 2	0	< 0.5	8	18	21	2	< 10	< 1
Roaring Fork Creek	JB97-01	451200 E 7067950 N	< 5	< 0.2	1	22	210	< 0.5	< 2	0	< 0.5	13	17	19	2	< 10	< 1
Right fork tributary to Roaring Fork Creek	JB97-02	451150 E 7067500 N	< 5	< 0.2	1	12	160	< 0.5	< 2	0	< 0.5	8	10	16	2	< 10	< 1
Canyon Creek	JB97-05	454050 E 7060450 N	10	< 0.2	1	12	200	< 0.5	2	0	< 0.5	8	14	14	2	< 10	< 1
No name tributary to Minto Creek	JB97-06	450100 E 7063550 N	< 5	< 0.2	1	10	180	< 0.5	< 2	0	< 0.5	5	9	10	1	< 10	< 1
Snowshoe Creek	JB97-07	459400 E 7094150 N	10	< 0.2	1	18	140	< 0.5	2	0	< 0.5	15	21	27	3	< 10	< 1
Field Creek	JB97-08	466250 E 7076275 N	10	< 0.2	1	22	180	< 0.5	< 2	0	< 0.5	8	13	14	2	< 10	< 1
Lower Field Creek	JB97-09	465300 E 7073100 N	5	< 0.2	1	24	180	< 0.5	< 2	0	< 0.5	8	14	17	2	< 10	< 1
Left fork of Upper Seattle Creek	JB97-13	450000 E 7176050 N	5	< 0.2	1	34	190	< 0.5	< 2	1	1	16	18	19	2	< 10	< 1
Middle fork of Upper Seattle Creek	JB97-14	449100 E 7175900 N	10	0	1	56	140	< 0.5	< 2	1	< 0.5	11	16	23	3	< 10	< 1
Right fork of Upper Seattle Creek	JB97-15	448750 E 7175800 N	10	< 0.2	1	26	130	< 0.5	< 2	1	< 0.5	11	22	23	3	< 10	< 1
Left fork tributary to Seattle Creek	JB97-17	445950 E 7079200 N	15	0	1	20	170	< 0.5	< 2	1	< 0.5	10	25	24	3	< 10	< 1
Left fork to Morrison Creek	JB97-19	445500 E 7076800 N	10	1	1	62	150	< 0.5	< 2	1	1	13	33	25	3	< 10	< 1
Right fork tributary to Seattle Creek	JB97-20	447400 E 7075050 N	10	1	1	62	240	< 0.5	< 2	0	< 0.5	11	18	17	2	< 10	< 1
Right fork tributary to Seattle Creek	JB97-21	447600 E 7075200 N	20	1	1	74	160	< 0.5	< 2	1	1	13	20	29	3	< 10	2

Stream	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
Fisher Creek	0	20	1	285	2	< 0.01	32	880	18	< 2	2	43	0	< 10	< 10	21	< 10	112
Fisher Creek	0	20	0	540	1	< 0.01	29	790	14	< 2	2	45	0	< 10	< 10	21	< 10	114
Sluice Creek	0	30	0	1310	3	< 0.01	83	800	16	< 2	2	65	0	< 10	< 10	21	< 10	280
Sluice Creek	0	20	0	1090	4	< 0.01	62	970	14	< 2	1	69	0	< 10	< 10	20	< 10	246
No name tributary to Ballard Creek	0	20	0	335	1	< 0.01	17	580	8	< 2	2	59	0	< 10	< 10	25	< 10	64
Ballard Creek	0	20	0	495	1	< 0.01	17	600	8	< 2	2	52	0	< 10	< 10	26	< 10	76
No name tributary to the E. McQuesten River	0	10	0	430	1	< 0.01	17	510	12	< 2	2	39	0	< 10	< 10	22	< 10	78
No name tributary to the E. McQuesten River	0	10	0	370	1	< 0.01	19	520	12	< 2	2	74	0	< 10	< 10	23	< 10	72
Larsen Creek	0	10	0	425	2	< 0.01	21	590	12	< 2	2	41	0	< 10	< 10	26	< 10	114
No name tributary to the E. McQuesten River	0	10	0	465	1	< 0.01	17	610	10	< 2	2	81	0	< 10	< 10	25	< 10	88
No name tributary to the E. McQuesten River	0	20	0	275	1	< 0.01	17	430	14	< 2	1	36	0	< 10	< 10	20	< 10	66
No name tributary to the E. McQuesten River	0	20	0	320	1	< 0.01	18	540	14	< 2	2	46	0	< 10	< 10	22	< 10	68
No name tributary to the E. McQuesten River	0	20	0	535	1	< 0.01	18	480	12	< 2	2	37	0	< 10	< 10	23	< 10	64
No name tributary to the E. McQuesten River	0	20	0	290	1	< 0.01	18	510	12	< 2	2	51	0	< 10	< 10	22	< 10	68
Sluice Creek	0	10	0	5330	6	< 0.01	274	940	8	2	3	79	0	< 10	< 10	25	< 10	1065
No name tributary to Sluice Creek	0	20	0	955	3	< 0.01	47	820	10	< 2	2	72	0	< 10	< 10	27	< 10	168
Davidson Creek	0	10	0	235	1	< 0.01	10	430	6	< 2	< 1	38	0	< 10	< 10	10	< 10	32
Christie Creek	0	40	0	465	1	< 0.01	18	530	12	< 2	1	34	0	< 10	< 10	21	< 10	62
No name tributary to Christie Creek	0	30	0	1295	1	< 0.01	54	630	12	< 2	2	34	0	< 10	< 10	28	< 10	210
No name tributary to the E. McQuesten River	0	40	0	380	1	< 0.01	22	520	10	< 2	1	24	0	< 10	< 10	15	< 10	50
Lime Creek	0	20	0	485	1	< 0.01	20	670	18	< 2	2	45	0	< 10	< 10	23	< 10	106
Skate Creek	0	10	1	450	3	0	20	860	18	< 2	3	34	0	< 10	< 10	37	< 10	116
McKim Creek	0	20	0	680	2	< 0.01	16	1230	6	< 2	2	28	0	< 10	< 10	29	< 10	68
No name tributary to Roop Creek	0	10	0	315	1	< 0.01	19	580	10	< 2	1	25	0	< 10	< 10	17	< 10	98
Granite Creek	0	30	0	410	1	< 0.01	14	1010	4	< 2	2	26	0	< 10	< 10	27	< 10	70
Hope Gulch	0	10	0	3370	3	< 0.01	29	900	1290	28	3	23	0	< 10	< 10	27	< 10	4340
Lightning Creek	0	10	0	2170	4	< 0.01	23	860	526	14	2	20	0	< 10	< 10	28	< 10	1815
Bear Creek	0	20	0	230	1	< 0.01	13	320	10	< 2	1	32	0	< 10	< 10	14	< 10	52
Williams Creek	0	20	0	435	3	< 0.01	16	640	12	2	2	29	0	< 10	< 10	27	< 10	66
Empire Creek	0	20	1	275	1	< 0.01	17	590	6	< 2	2	31	0	< 10	< 10	24	< 10	46
Roaring Fork Creek	0	30	0	535	< 1	< 0.01	23	580	24	6	1	31	0	< 10	< 10	18	< 10	84
Right fork tributary to Roaring Fork Creek	0	30	0	340	< 1	< 0.01	16	400	12	< 2	1	36	0	< 10	< 10	14	< 10	48
Canyon Creek	0	30	0	385	1	< 0.01	17	470	10	< 2	1	32	0	< 10	< 10	16	< 10	60
No name tributary to Minto Creek	0	20	0	185	< 1	< 0.01	11	430	8	< 2	1	28	0	< 10	< 10	14	< 10	46
Snowshoe Creek	0	30	0	600	1	< 0.01	34	760	20	4	2	45	0	< 10	< 10	21	< 10	84
Field Creek	0	10	0	495	< 1	< 0.01	17	540	8	< 2	1	29	0	< 10	< 10	19	< 10	54
Lower Field Creek	0	20	0	385	< 1	< 0.01	18	520	10	< 2	1	35	0	< 10	< 10	19	< 10	66
Left fork of Upper Seattle Creek	0	30	0	880	1	< 0.01	24	620	18	< 2	2	47	0	< 10	< 10	24	< 10	112
Middle fork of Upper Seattle Creek	0	40	0	375	< 1	< 0.01	26	510	18	6	2	67	0	< 10	< 10	14	< 10	72
Right fork of Upper Seattle Creek	0	30	1	490	1	< 0.01	28	550	16	6	2	64	0	< 10	< 10	18	< 10	80
Left fork tributary to Seattle Creek	0	40	1	475	1	< 0.01	27	620	18	< 2	2	52	0	< 10	< 10	25	< 10	92
Left fork to Morrison Creek	0	30	1	720	1	< 0.01	34	530	22	< 2	3	44	0	< 10	< 10	28	< 10	136
Right fork tributary to Seattle Creek	0	30	0	630	1	< 0.01	16	620	20	< 2	2	28	0	< 10	< 10	29	< 10	56
Right fork tributary to Seattle Creek	0	30	0	830	1	< 0.01	27	500	26	6	3	47	< 0.01	< 10	< 10	20	< 10	102

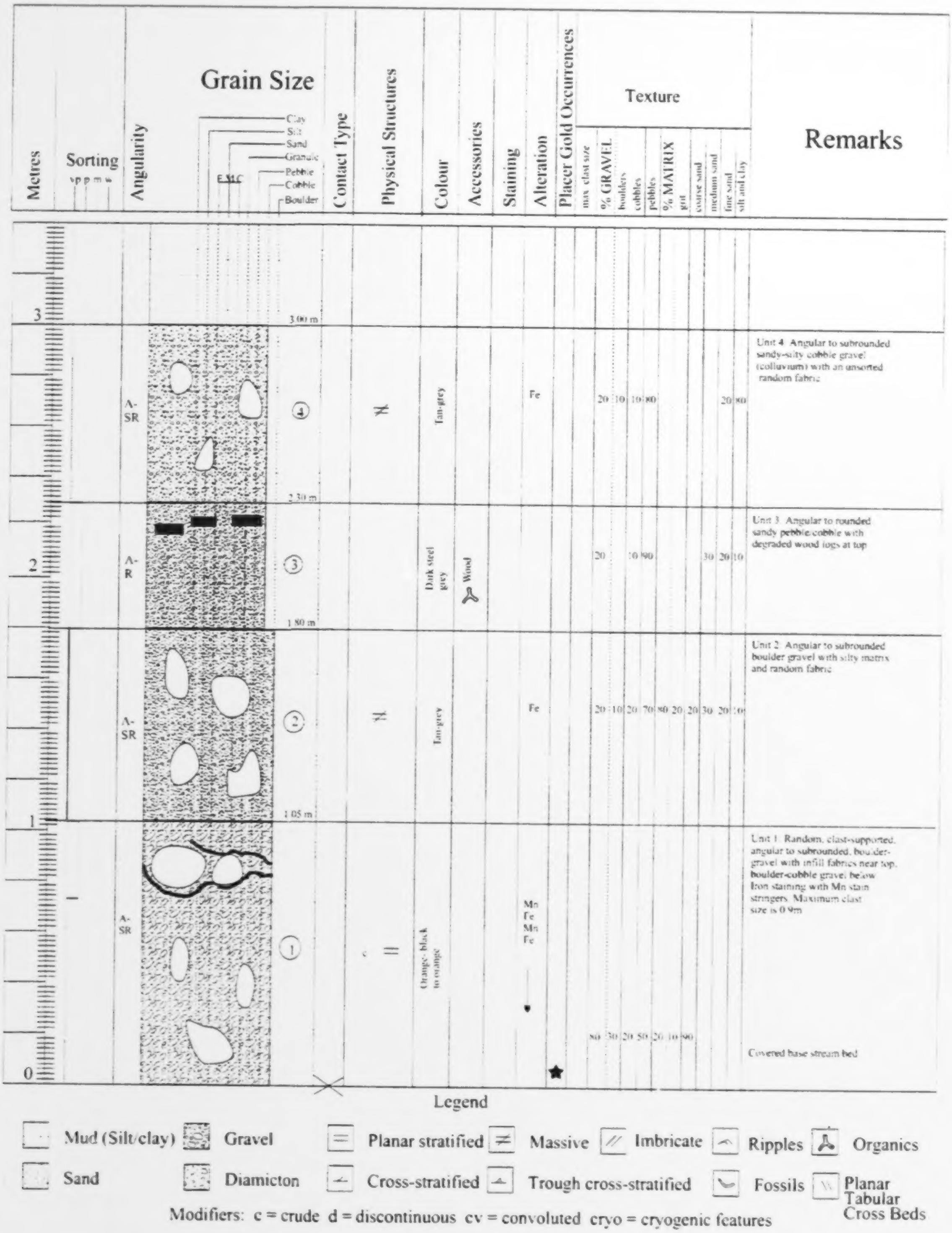
Stream	Sample number	Location UTM	Au ppb	Ag ppb	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm
Russell Creek	JB97-22	580100 E 6998500 N	< 5	< 0.2	1	12	170	< 0.5	< 2	0	< 0.5	11	15	21	3	< 10	< 1
Upper Morrison Creek	JB97-23	440600 E 7075500 N	75	< 0.2	1	50	180'	< 0.5	< 2	0	< 0.5	10	18	17	2	< 10	< 1
Bennett Creek	JB97-25	447050 E 7069500 N	10	< 0.2	1	90	90	< 0.5	< 2	0	< 0.5	9	11	17	2	< 10	< 1
Sunday Creek	JB97-26	441400 E 7063400 N	10	< 0.2	1	12	130	< 0.5	< 2	0	< 0.5	5	12	8	1	< 10	< 1
Upper Parent Creek	JB97-27	483750 E 7079150 N	< 5	0	1	18	100	< 0.5	2	0	< 0.5	5	19	48	3	< 10	< 1
Upper Parent Creek	JB97-28	483150 E 7079600 N	15	0	1	18	220	< 0.5	< 2	0	2	12	18	27	3	< 10	1
Left fork tributary to Sprague Creek	JB97-29	426075 E 7086900 N	5	< 0.2	1	14	110	< 0.5	< 2	0	1	11	19	18	2	< 10	< 1
Gem Creek	JB97-30	411300 E 7093800 N	260	0	2	434	200	< 0.5	2	0	< 0.5	17	23	126	5	< 10	< 1
Arizona Creek	JB97-31	408400 E 7096400 N	< 5	< 0.2	1	10	290	< 0.5	< 2	1	1	14	21	28	3	< 10	< 1
Big Creek	JB97-32	406650 E 7085350 N	15	0	1	32	130	< 0.5	< 2	0	1	12	23	23	2	< 10	< 1
Granite Creek	JB97-33	407250 E 7085050 N	10	< 0.2	1	16	120	< 0.5	< 2	0	1	13	33	30	3	< 10	< 1
Upper left fork tributary to Forty Mile Creek	JB97-34	403800 E 7078250 N	520	4	1	144	110	< 0.5	< 2	0	3	12	18	25	3	< 10	< 1
Castnor Creek	JB97-38	435475 E 7077850 N	10	< 0.2	1	8	120	< 0.5	2	0	< 0.5	10	25	17	2	< 10	< 1
Laska Gulch	JB97-39	435300 E 7077900 N	< 5	< 0.2	1	20	120	< 0.5	< 2	0	1	17	18	16	3	< 10	< 1
Crystal Creek	JB97-40	482000 E 7091075 N	15	16	1	188	200	< 0.5	< 2	1	22	7	12	26	2	< 10	< 1
Main tributary to Empire Creek	JB97-42	470450 E 7036050 N	< 5	< 0.2	1	16	140	< 0.5	< 2	1	< 0.5	15	43	41	3	< 10	1
Unnamed tributary to Talbot Lake	JB97-43	464900 E 7036800 N	< 5	< 0.2	1	8	160	< 0.5	< 2	1	< 0.5	11	23	24	2	< 10	< 1
Right fork to Talbot Creek	JB97-44	457900 E 7042350 N	< 5	< 0.2	1	16	80	< 0.5	2	0	< 0.5	14	12	28	3	< 10	< 1
Upper Talbot Creek	JB97-45	461100 E 7044700 N	< 5	< 0.2	1	10	130	< 0.5	< 2	0	< 0.5	11	27	20	2	< 10	< 1
No name tributary to Stewart River	JB97-46	469100 E 7044450 N	10	< 0.2	1	6	200	< 0.5	< 2	0	< 0.5	9	17	13	2	< 10	< 1
Goodman Creek	JB97-48	443125 E 7087150 N	< 5	< 0.2	1	12	150	< 0.5	8	0	< 0.5	9	14	19	2	< 10	< 1
Sunshine Creek	DM97-01	421050 E 7079500 N	< 5	1	1	36	170	1	2	0	1	14	21	32	3	< 10	< 1
Left fork tributary to Sprague Creek	DM97-02	419650 E 7087200 N	< 5	< 0.2	1	16	120	< 0.5	2	0	< 0.5	12	22	22	2	< 10	< 1
Hobo Creek	DM97-03	408150 E 7097350 N	20	< 0.2	1	102	160	1	< 2	0	1	12	22	33	3	< 10	< 1
Drapeau Creek	DM97-04	408550 E 7097000 N	10	< 0.2	1	12	310	1	< 2	1	1	15	24	36	3	< 10	< 1
Left fork tributary to Big Creek	DM97-05	408250 E 7089950 N	10	0	2	18	670	1	< 2	1	1	11	36	24	3	< 10	< 1
Josephine Creek	DM97-06	400800 E 7084850 N	355	0	2	532	140	1	< 2	0	1	20	31	41	3	< 10	< 1
Upper right fork tributary to Forty Mile Creek	DM97-07	409750 E 7079925 N	15	0	1	78	70	< 0.5	6	0	< 0.5	21	16	39	4	< 10	< 1
Upper Bear Creek	DM97-08	433525 E 7064250 N	110	< 0.2	1	10	130	< 0.5	2	0	< 0.5	11	16	19	2	< 10	< 1
Right fork tributary to Bear Creek	DM97-09	433625 E 7064300 N	5	< 0.2	1	18	120	< 0.5	< 2	0	< 0.5	10	14	16	2	< 10	< 1
Shanghai Creek	JB97-49	465275 E 7089950 N	10	10	1	22	230	< 0.5	< 2	2	< 0.5	10	17	23	2	< 10	< 1
Allen Creek	JB97-50	498450 E 7088450 N	< 5	< 5	2	20	190	< 0.5	< 2	0	< 0.5	26	28	89	3	< 10	< 1
Left fork tributary to Allen Creek	JB97-52	498800 E 7088700 N	< 5	< 5	1	56	170	< 0.5	< 2	0	< 0.5	24	35	92	3	< 10	< 1

Stream	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
Russell Creek	0	30	0	615	1	< 0.01	21	510	10	< 2	1	19	0	< 10	< 10	21	< 10	68
Upper Morrison Creek	0	20	0	530	1	< 0.01	19	580	8	< 2	2	20	0	< 10	< 10	27	< 10	70
Bennett Creek	0	30	0	360	< 1	< 0.01	18	430	12	8	1	19	0	< 10	< 10	14	< 10	56
Sunday Creek	0	20	0	205	1	< 0.01	11	370	8	< 2	1	32	0	< 10	< 10	16	< 10	42
Upper Parent Creek	0	30	0	170	3	< 0.01	18	550	22	< 2	1	8	< 0.01	< 10	10	24	< 10	74
Upper Parent Creek	0	30	0	350	3	< 0.01	42	730	14	2	1	23	0	< 10	< 10	27	< 10	230
Left fork tributary to Sprague Creek	0	30	0	290	< 1	< 0.01	21	490	14	< 2	1	21	0	< 10	< 10	22	< 10	80
Gem Creek	0	30	0	560	4	< 0.01	29	820	32	< 2	3	34	0	< 10	< 10	49	< 10	122
Arizona Creek	0	30	1	530	2	< 0.01	27	980	12	< 2	4	59	0	< 10	< 10	35	< 10	96
Big Creek	0	30	0	385	< 1	< 0.01	24	540	16	< 2	3	22	0	< 10	< 10	30	< 10	76
Granite Creek	0	30	1	275	1	< 0.01	31	670	32	14	3	37	0	< 10	< 10	34	< 10	92
Upper left fork tributary to Forty Mile Creek	0	30	0	650	< 1	< 0.01	23	520	46	< 2	1	20	0	< 10	< 10	24	< 10	208
Castnor Creek	0	30	1	400	1	< 0.01	23	570	16	2	2	31	0	< 10	< 10	23	< 10	90
Laska Gulch	0	30	0	1260	1	< 0.01	28	400	22	< 2	1	18	0	< 10	< 10	21	< 10	228
Crystal Creek	0	< 10	1	3600	2	< 0.01	26	770	888	18	1	28	0	< 10	< 10	20	< 10	1640
Main tributary to Empire Creek	0	10	1	500	< 1	< 0.01	39	610	8	< 2	4	46	0	< 10	< 10	40	< 10	60
Unnamed tributary to Talbot Lake	0	30	1	395	< 1	< 0.01	24	620	8	< 2	3	34	0	< 10	< 10	29	< 10	52
Right fork to Talbot Creek	0	50	0	435	1	< 0.01	29	480	12	< 2	1	26	0	< 10	< 10	14	< 10	72
Upper Talbot Creek	0	30	1	400	< 1	< 0.01	26	650	8	< 2	3	34	0	< 10	< 10	27	< 10	58
No name tributary to Stewart River	0	20	0	415	< 1	< 0.01	17	490	8	2	2	25	0	< 10	< 10	23	< 10	54
Goodman Creek	0	30	0	405	1	< 0.01	19	500	12	4	2	37	0	< 10	< 10	21	< 10	56
Sunshine Creek	0	20	0	900	< 1	< 0.01	23	650	14	< 2	1	18	0	< 10	< 10	30	< 10	134
Left fork tributary to Sprague Creek	0	30	0	390	< 1	< 0.01	24	520	16	< 2	2	28	0	< 10	< 10	26	< 10	72
Hobo Creek	0	20	0	600	3	< 0.01	28	580	18	< 2	3	30	0	< 10	< 10	39	< 10	134
Drapeau Creek	0	20	0	1095	4	< 0.01	40	820	16	< 2	4	58	0	< 10	< 10	39	< 10	170
Left fork tributary to Big Creek	0	30	1	980	1	< 0.01	24	1090	10	< 2	5	67	0	< 10	< 10	50	< 10	98
Josephine Creek	0	30	1	585	1	< 0.01	44	650	10	< 2	4	32	0	< 10	< 10	38	10	94
Upper right fork tributary to Forty Mile Creek	0	40	0	670	1	< 0.01	40	500	30	6	1	18	0	< 10	< 10	18	< 10	104
Upper Bear Creek	0	40	0	385	1	< 0.01	21	550	14	8	2	34	0	< 10	< 10	19	< 10	70
Right fork tributary to Bear Creek	0	40	0	270	1	< 0.01	18	490	14	< 2	1	35	0	< 10	< 10	16	< 10	62
Shanghai Creek	0	20	1	530	1	< 0.01	22	690	16	< 2	3	61	0	< 10	< 10	30	< 10	76
Allen Creek	0	40	1	925	2	< 0.01	119	870	20	4	3	27	0	< 10	< 10	33	< 10	590
Left fork tributary to Allen Creek	0	40	1	1140	2	< 0.01	66	700	38	< 2	3	14	0	< 10	< 10	31	< 10	286

Appendix 4. Measured sections

Duncan Creek/Keno Hill

Date: 02/07/96 Section number: FH9601/ Lw9605 Measured by: FJH Creek or River: Upper Duncan Creek NTS: 105M14
Latitude: 63°52.21 Longitude: 135°11.48 Elevation: 4120 to 4180 UTM:
Orientation: 269 <——> 089 upstream Geomorphic landform: Valley Fill-Disected Alluvial Fan



Unit 4 Angular to subrounded sandy-silty cobble gravel (colluvium) with an unsorted random fabric

Unit 3 Angular to rounded sandy pebble-cobble with degraded wood logs at top

Unit 2 Angular to subrounded boulder gravel with silty matrix and random fabric

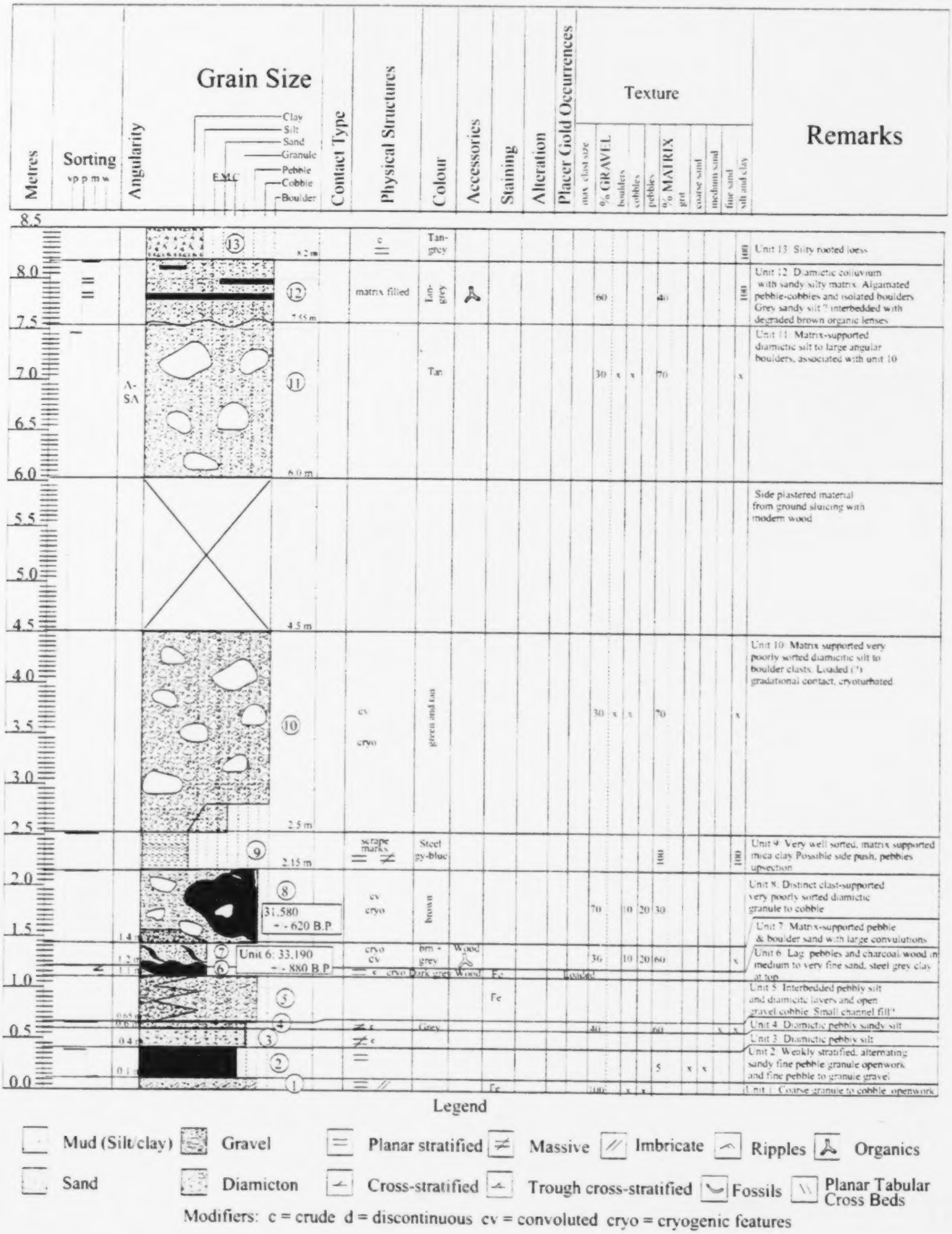
Unit 1 Random, clast-supported, angular to subrounded, boulder-gravel with infill fabrics near top, boulder-cobble gravel below Iron staining with Mn stain stringers. Maximum clast size is 0.9m

Covered base stream bed

Date 04/07/96 Section number: FH-96-02 Measured by: WPL/MR Creek or River: Duncan Creek NTS: 105M14

Latitude: 63°52.64 Longitude: 135°18.45 Elevation: 3240 ft UTM: 0476570E,7076621N

Orientation: 310 ←→ 130 upstream Geomorphic landform: Valley



Unit 13: Silty rooted loess

Unit 12: Diamictic colluvium with sandy silty matrix. Algamated pebble-cobbles and isolated boulders. Grey sandy silt ? interbedded with degraded brown organic lenses

Unit 11: Matrix-supported diamictic silt to large angular boulders, associated with unit 10

Side plastered material from ground sluicing with modern wood

Unit 10: Matrix supported very poorly sorted diamictic silt to boulder clasts. Loaded (?) gradational contact, cryoturbated

Unit 9: Very well sorted, matrix supported mica clay. Possible side push, pebbles upsection

Unit 8: Distinct clast-supported very poorly sorted diamictic granule to cobble

Unit 7: Matrix-supported pebble & boulder sand with large convolutions

Unit 6: Lag pebbles and charcoal wood in medium to very fine sand, steel grey clay at top

Unit 5: Interbedded pebbly silt and diamicite layers and open gravel cobble. Small channel fill?

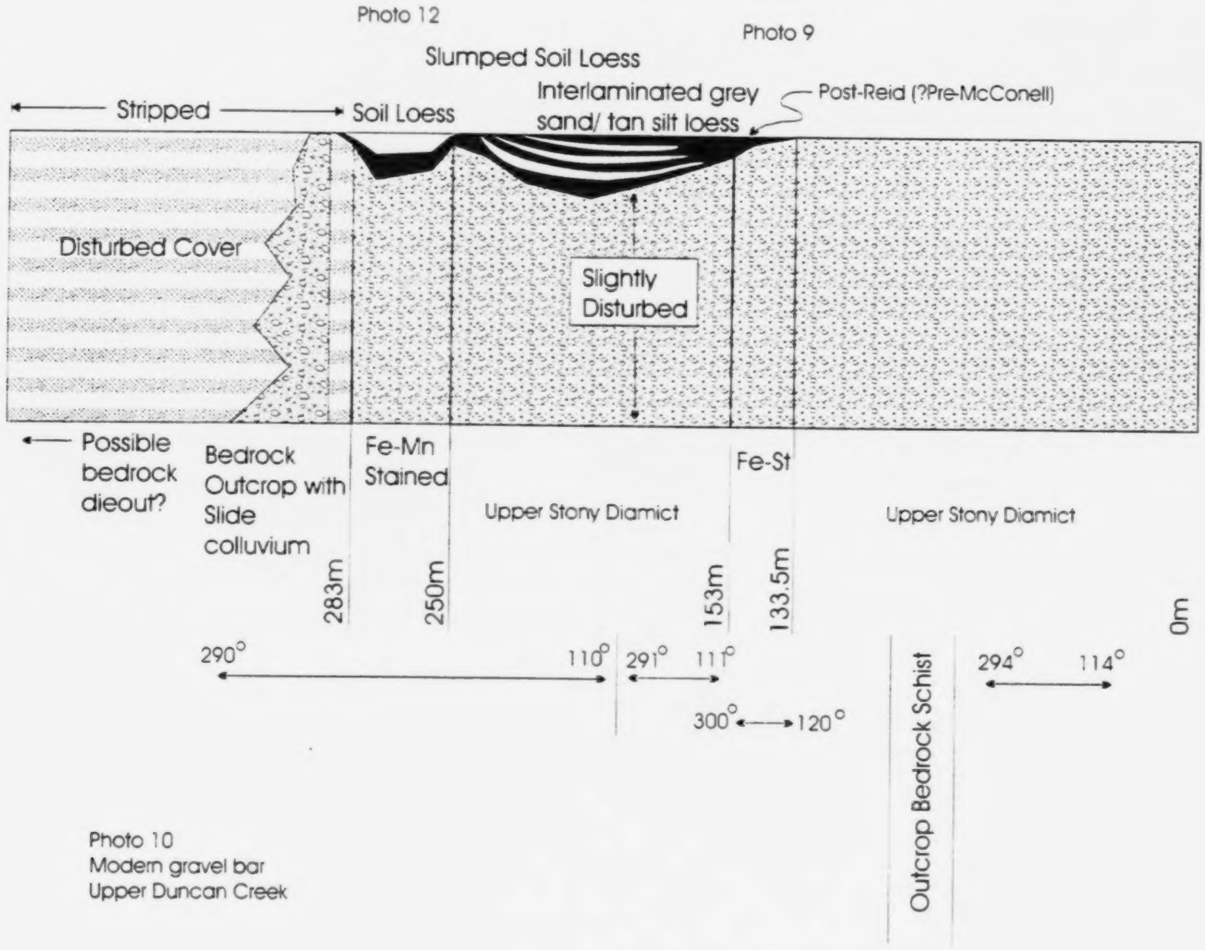
Unit 4: Diamictic pebbly sandy silt

Unit 3: Diamictic pebbly silt

Unit 2: Weakly stratified, alternating sandy fine pebble granule openwork and fine pebble to granule gravel

Unit 1: Coarse granule to cobble, openwork

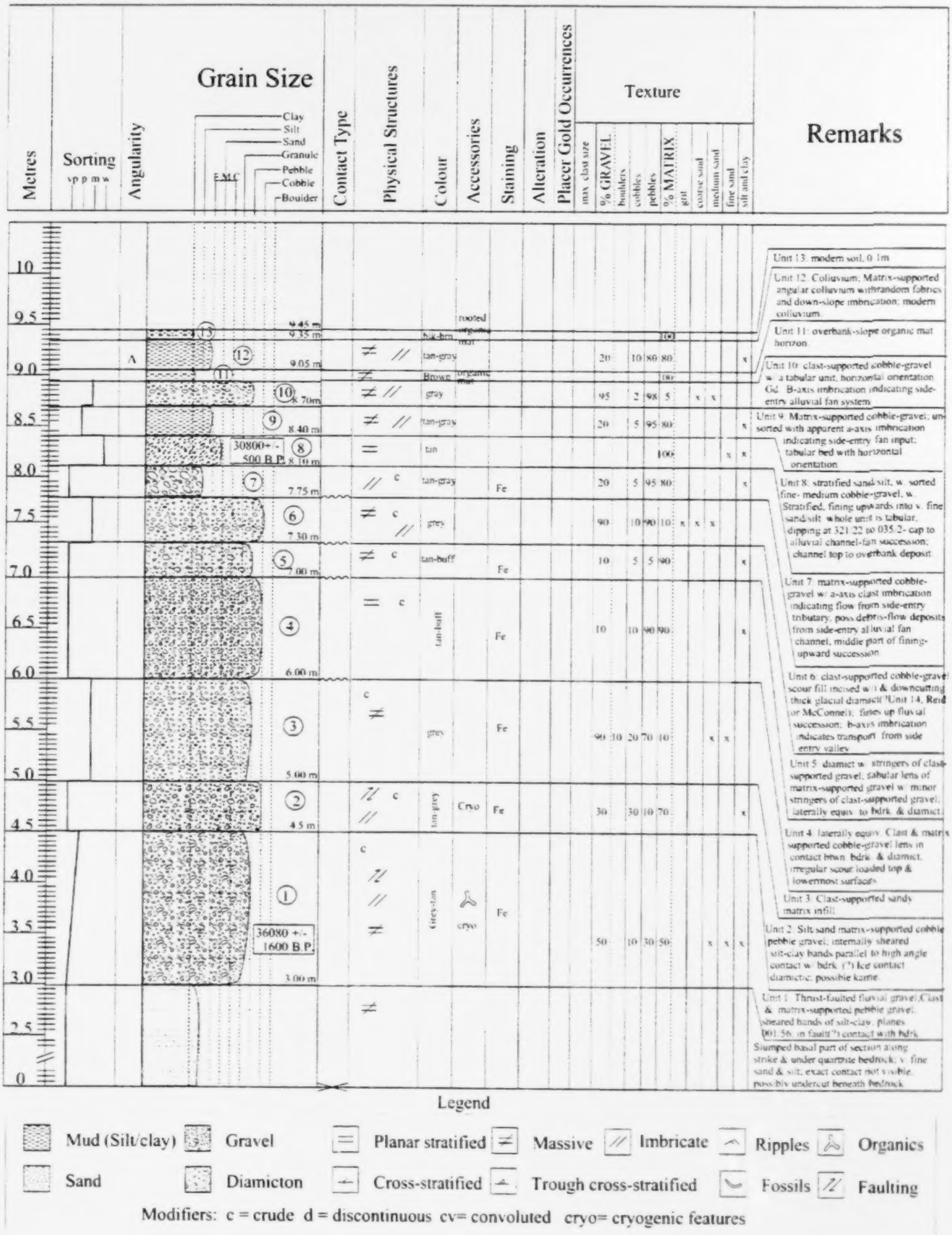
Date: 08/07/96 Section number: FH96-02A Measured by: Creek or River: Upper Duncan Creek NTS:
Latitude: 63 52.64N Longitude: 135 18.45"W Elevation: UTM:
Orientation: 310 ⟷ 130 upstream Geomorphic landform: modern gravel bar downstream from measured section



Date: 12/07/96 Section number: FH96012 Measured by: WPL/FJH/LM Creek or River: Duncan Creek NTS: 105M14

Latitude: 63°52'44"N Longitude: 135°22'39"W Elevation: 2740 ft UTM: 0481455E,7083376N

Orientation: 076 ⟷ 256 upstream Geomorphic landform: Alluvial Fan



Unit 13: modern soil, 0.1m

Unit 12: Colluvium; Matrix-supported angular colluvium withrandom fabrics and down-slope imbrication; modern colluvium.

Unit 11: overbank-slope organic mat horizon.

Unit 10: clast-supported cobble-gravel w/ a tabular unit, horizontal orientation Gd. B-axis imbrication indicating side-entry alluvial fan system.

Unit 9: Matrix-supported cobble-gravel; unsorted with apparent a-axis imbrication indicating side-entry fan input; tabular bed with horizontal orientation.

Unit 8: stratified sand/silt, w/ sorted fine- medium cobble-gravel, w/ Stratified, fining upwards into v. fine sand/silt whole unit is tabular, dipping at 321/22 to 035/2- cap to alluvial channel-fan succession; channel top to overbank deposit.

Unit 7: matrix-supported cobble-gravel w/ a-axis clast imbrication indicating flow from side-entry tributary, poss debris-flow deposits from side-entry alluvial fan channel, middle part of fining-upward succession.

Unit 6: clast-supported cobble-gravel scour fill incised w/ & downcutting thick glacial diamict (?Unit 14, Reid or McConnell); fines up fluvial succession; b-axis imbrication indicates transport from side entry valley.

Unit 5: diamict w/ stringers of clast-supported gravel, tabular lens of matrix-supported gravel w/ minor stringers of clast-supported gravel; laterally equiv. to bdrk & diamict.

Unit 4: laterally equiv. Clast & matrix supported cobble-gravel lens in contact btwn bdrk & diamict, irregular scour loaded top & lowermost surfaces.

Unit 3: Clast-supported sandy matrix infill.

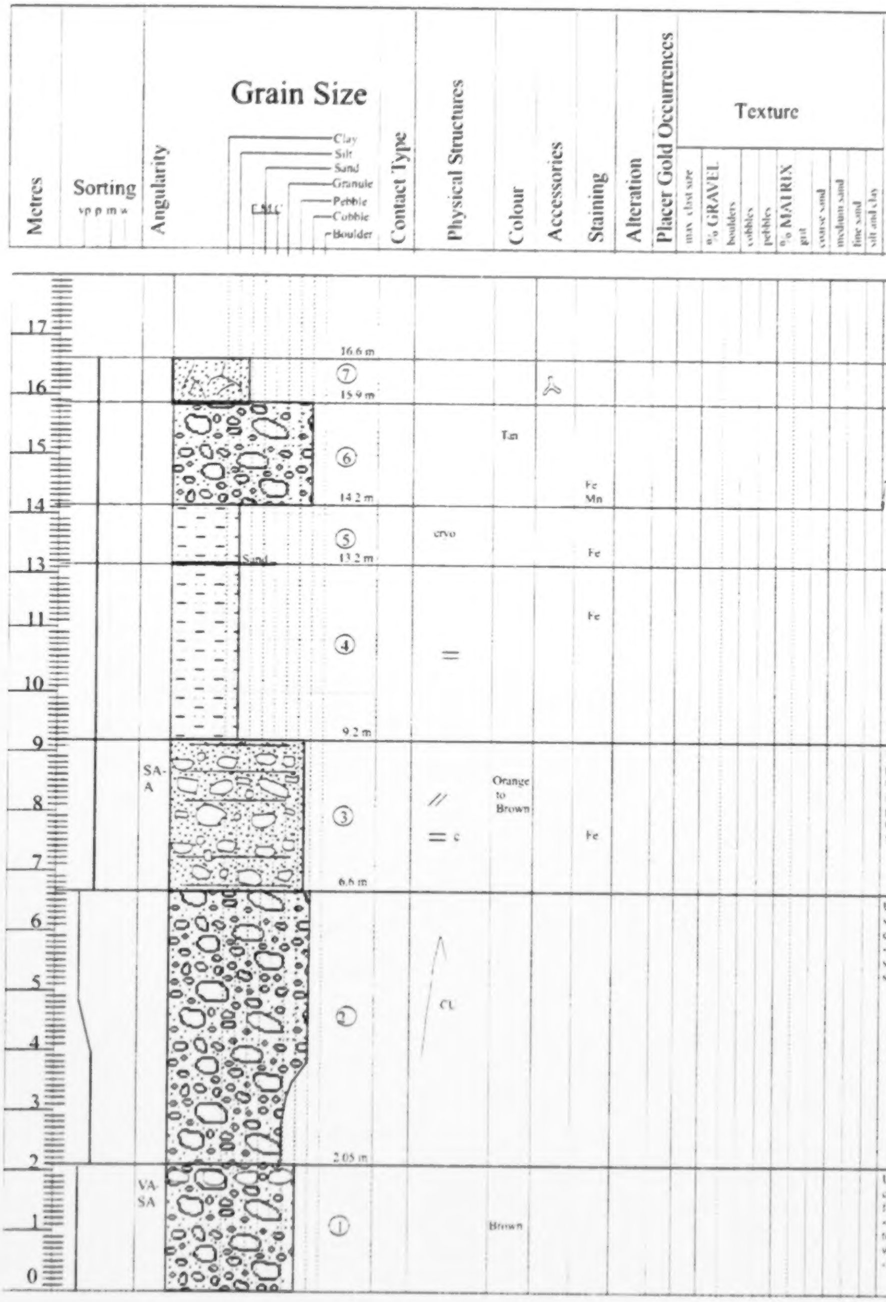
Unit 2: Silt/sand matrix-supported cobble pebble gravel; internally sheared silt-clay bands parallel to high angle contact w/ bdrk (?) ice contact diamictic; possible kame.

Unit 1: Thrust-faulted fluvial gravel;Clast & matrix-supported pebble gravel, sheared bands of silt-clay, planes (001/56) in fault(?) contact with bdrk.

Slumped basal part of section along strike & under quartzite bedrock; v. fine sand & silt; exact contact not visible, possibly undercut beneath bedrock.

Modifiers: c = crude d = discontinuous cv= convoluted cryo= cryogenic features

Date: 15/08/96 Section number: FH9618 Measured by: FJH, LW Creek or River: Thunder Gulch NTS: 105M/14
Latitude: 63°53.97 Longitude: 135°15.07 Elevation: 3790 ft UTM: 487670E, 7085643N 2nd tributary to lacustrine section
Orientation: 128° us ⟷ 348° ds Geomorphic landform: Gulch gravels



Remarks

Unit 7: consists of rooted colluvium and modern soil

Unit 6: is a matrix supported cobble-diamict. The clasts are striated, and consist of flat cobbles

Unit 5: contains discontinuous sand partings (sand fill?), that are approximately two cm thick. The top 60 cm of this unit are cryoturbated

Unit 4: is comprised of graded to laminated layers of silt and clay
Lacustrine?

Unit 3: clast supported pebble-cobble gravel with a medium to coarse sand matrix.
Imbricate into section, possibly paleoflow to 205
Glaciofluvial or interglacial fluvial

Unit 2: consists of a matrix supported pebble-sand that coarsens upwards to a fine sand silt
-Clasts mainly cobble-sized, some are flat-iron shaped, and some have striations

Unit 1 Glacial diamict
cobble gravel with a matrix of fine sand-clay-silt
-dominantly matrix supported, however topmost portion of unit is clast supported with very angular clasts
-Boulders, striated and flat-iron pebbles

Legend

☐	Mud (Silt/clay)	▒	Gravel	=	Planar stratified	≠	Massive	//	Imbricate	⌒	Ripples	⅄	Organics
⬚	Sand	▒	Diamicton	∠	Cross-stratified	⌣	Trough cross-stratified	◡	Fossils	⧄	Planar Tabular Cross Beds		

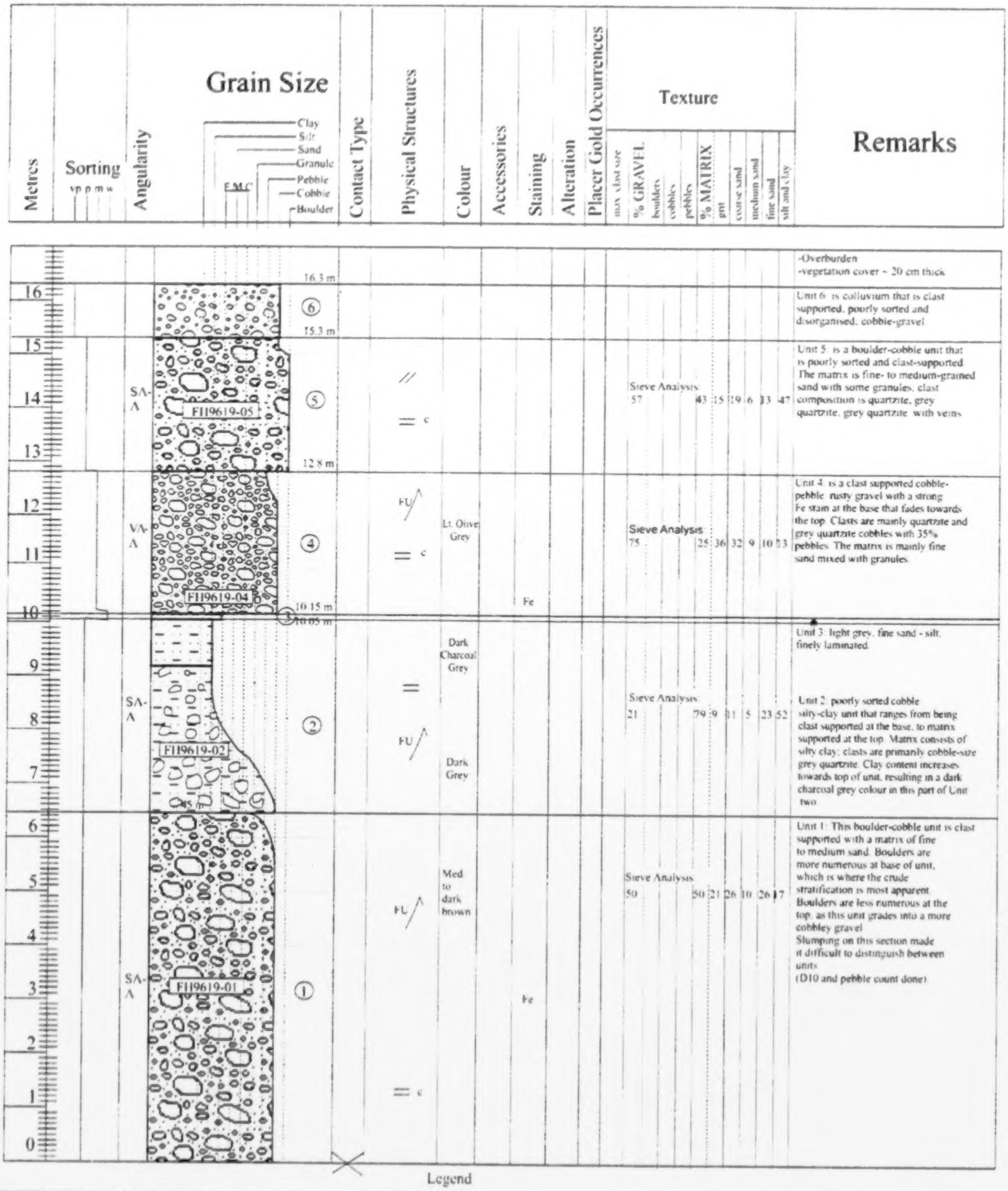
Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 16/08/96 Section number: FH9619-1 Measured by: LW Creek or River: Thunder Gulch NTS: 105M/14

Latitude: 63°54.00' Longitude: 135°14.77' Elevation: 3710 ft UTM: 487917E, 7085846N

Orientation: 135° us ⟷ 315° ds Geomorphic landform: Gulch gravels

First logged on NW end down stream blue-grey boulder unit. Section is moderately indurated on the surface, difficult to cut steps.



-Overburden
-vegetation cover ~ 20 cm thick

Unit 6: is colluvium that is clast supported, poorly sorted and disorganised, cobble-gravel

Unit 5: is a boulder-cobble unit that is poorly sorted and clast-supported. The matrix is fine- to medium-grained sand with some granules. clast composition is quartzite, grey quartzite, grey quartzite with veins

Unit 4: is a clast supported cobble-pebble rusty gravel with a strong Fe stain at the base that fades towards the top. Clasts are mainly quartzite and grey quartzite cobbles with 35% pebbles. The matrix is mainly fine sand mixed with granules.

Unit 3: light grey, fine sand - silt, finely laminated.

Unit 2: poorly sorted cobble silty-clay unit that ranges from being clast supported at the base, to matrix supported at the top. Matrix consists of silty clay; clasts are primarily cobble-size grey quartzite. Clay content increases towards top of unit, resulting in a dark charcoal grey colour in this part of Unit two

Unit 1: This boulder-cobble unit is clast supported with a matrix of fine to medium sand. Boulders are more numerous at base of unit, which is where the crude stratification is most apparent. Boulders are less numerous at the top, as this unit grades into a more cobbley gravel
Slumping on this section made it difficult to distinguish between units
(D10 and pebble count done)

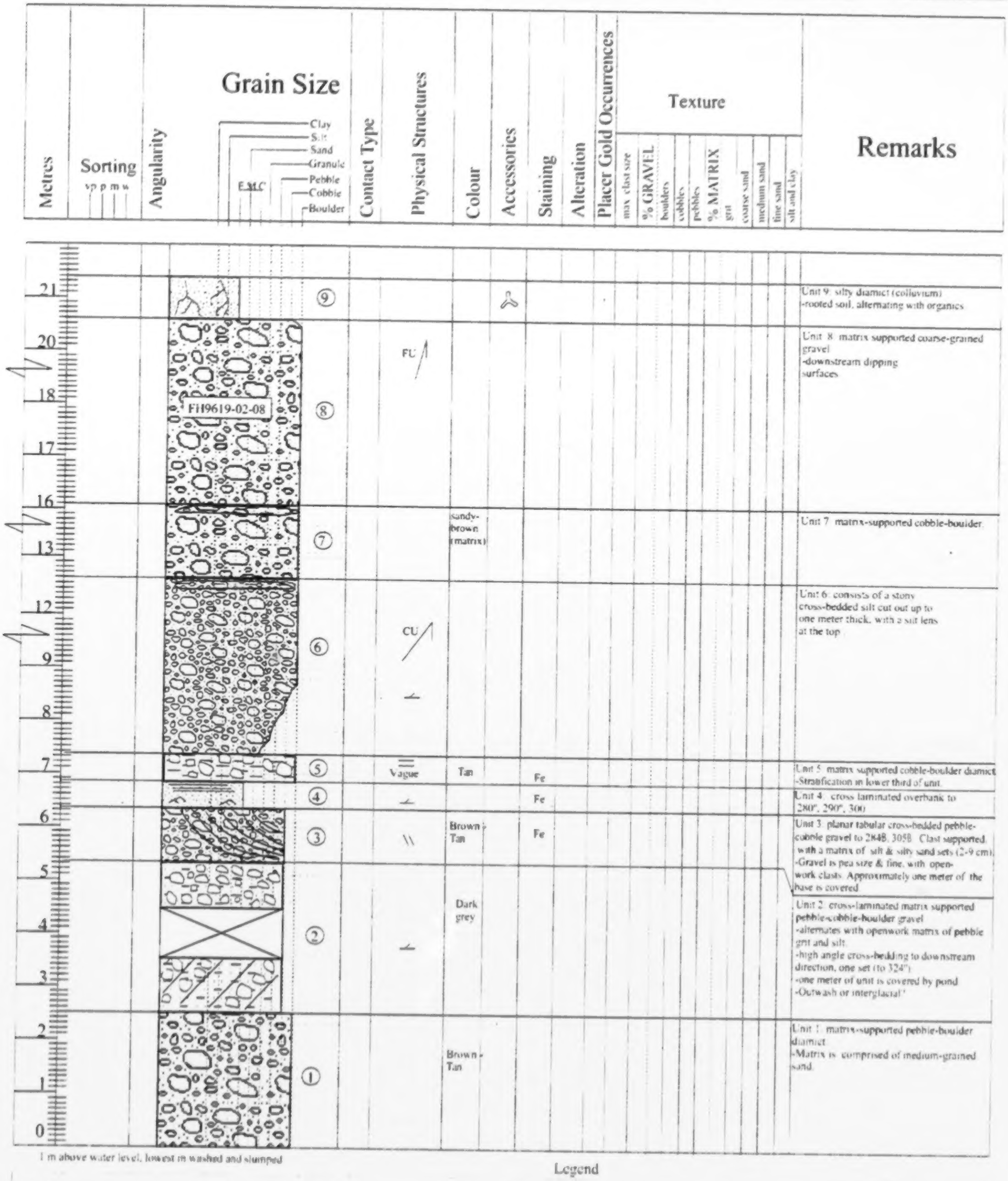
Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples Organics

☐ Sand ▨ Diamicton Cross-stratified Trough cross-stratified Fossils Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 20/08/96 Section number: FH9619-2 Measured by: FJH, LM Creek or River: Thunder Gulch NTS: 105M/14
Latitude: 63°54.08 Longitude: 135°14.92 Elevation: 3750 ft UTM: 487794E, 7085846N
Orientation: 144° us ⟷ 324° ds Geomorphic landform: Gulch gravels



Unit 9: silty diamict (colluvium)
-rooted soil, alternating with organics

Unit 8: matrix supported coarse-grained gravel
-downstream dipping surfaces

Unit 7: matrix-supported cobble-boulder.

Unit 6: consists of a stony cross-bedded silt cut out up to one meter thick, with a silt lens at the top.

Unit 5: matrix supported cobble-boulder diamict
-Stratification in lower third of unit.

Unit 4: cross laminated overbank to 280°, 290°, 300

Unit 3: planar tabular cross-bedded pebble-cobble gravel to 284B, 305B. Clast supported, with a matrix of silt & silty sand sets (2-9 cm).
-Gravel is pea size & fine, with open-work clasts. Approximately one meter of the base is covered.

Unit 2: cross-laminated matrix supported pebble-cobble-boulder gravel
-alternates with openwork matrix of pebble grit and silt.
-high angle cross-bedding to downstream direction, one set (to 324°)
-one meter of unit is covered by pond
-Outwash or interglacial?

Unit 1: matrix-supported pebble-boulder diamict
-Matrix is comprised of medium-grained sand.

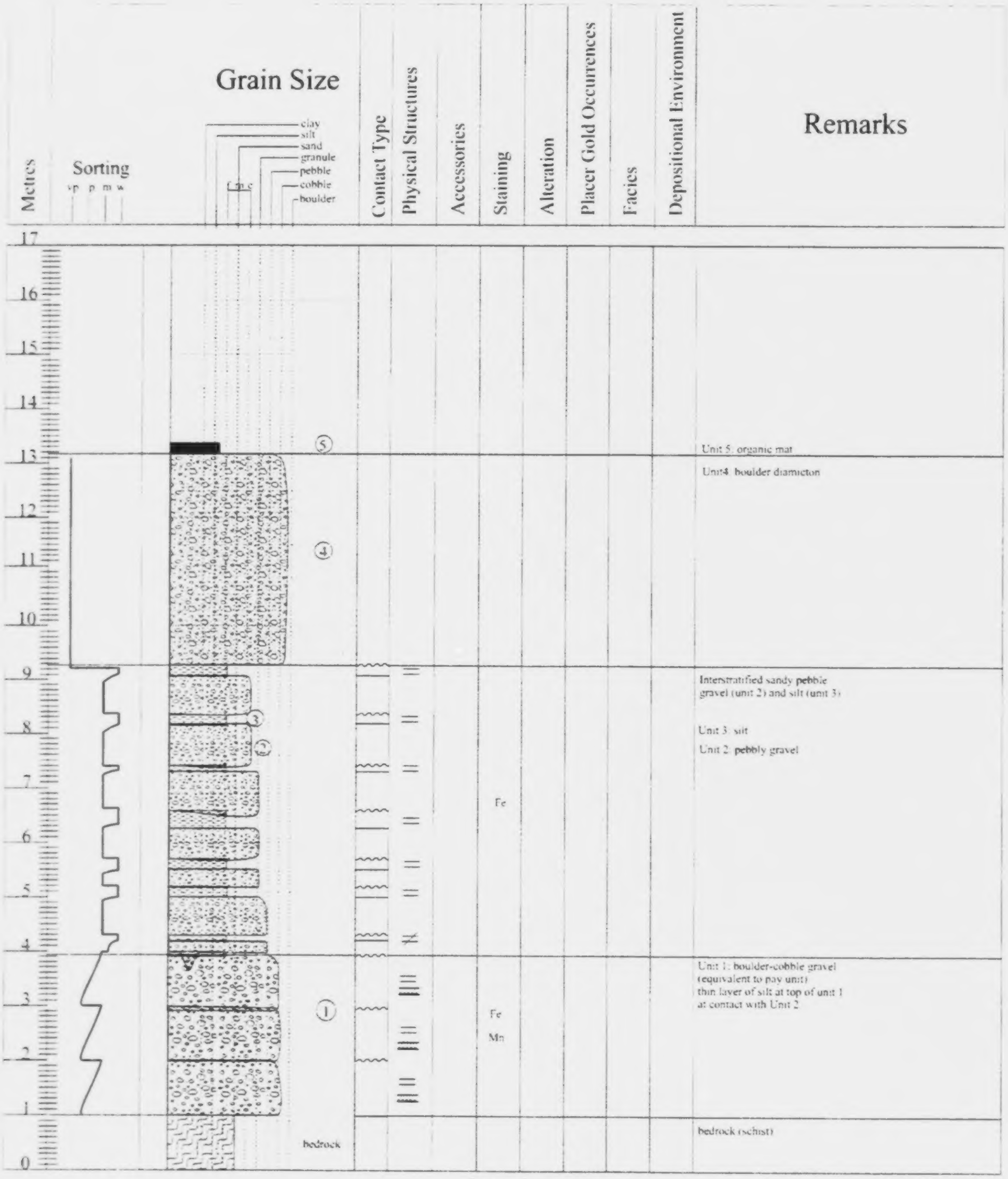
1 m above water level, lowest m washed and slumped

Legend

⬚ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
⬚ Sand	▨ Diamicton	⟋ Cross-stratified	⌣ Trough cross-stratified	⌣ Fossils	\\ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 30/07/95 Section Number: FT1-95 Measured by: WPL Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°48'34"N Longitude: 135°29'12"W Elevation: 2420 Geomorphic Landform: Glaciofluvial Terrace
Orientation: 326 <------------> 146 downstream



Unit 5: organic mat

Unit4: boulder diamicton

Interstratified sandy pebble gravel (unit 2) and silt (unit 3)

Unit 3: silt

Unit 2: pebbly gravel

Unit 1: boulder-cobble gravel
(equivalent to pay unit)
thin layer of silt at top of unit 1
at contact with Unit 2

bedrock (schist)

Legend

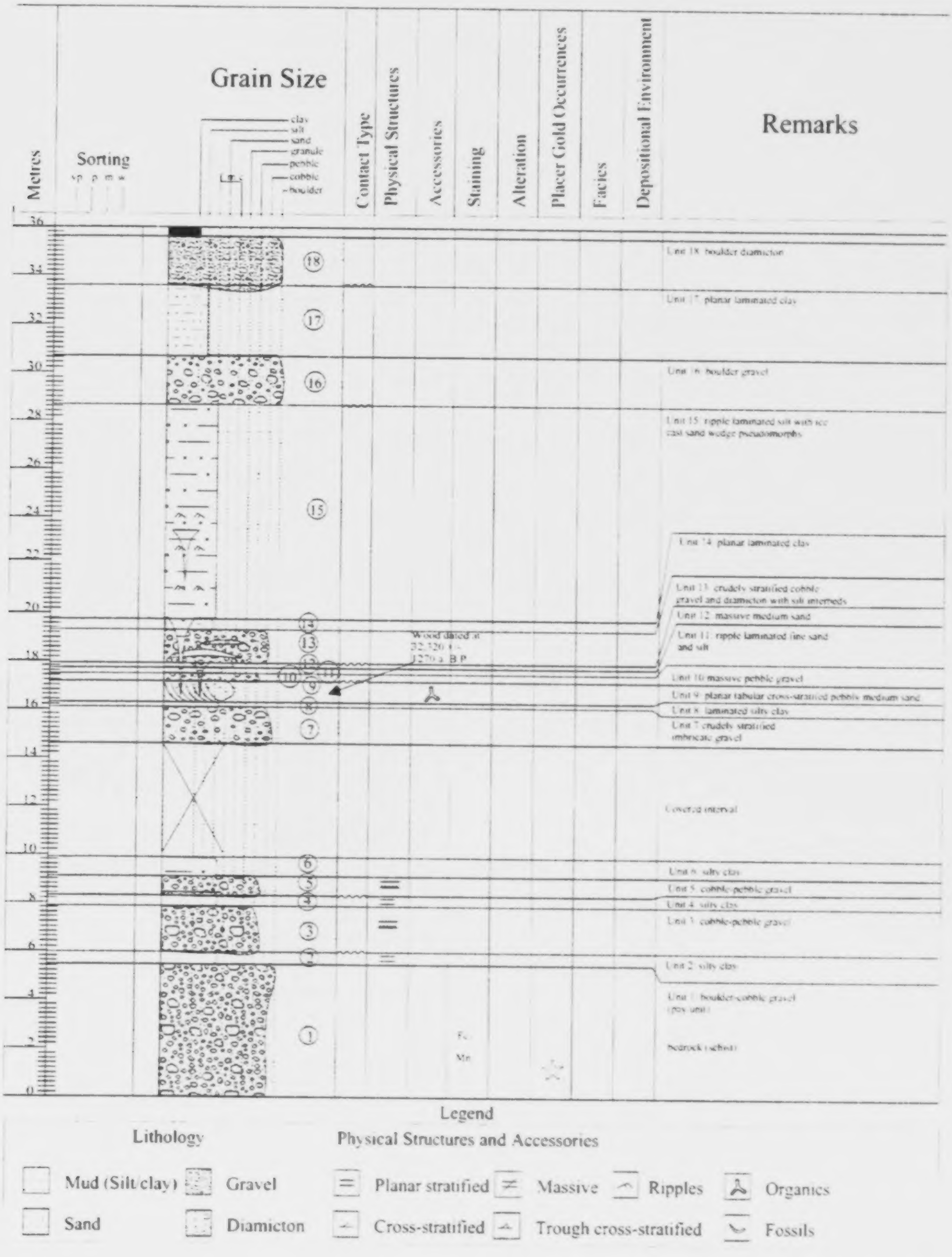
Lithology

Mud (Silt/clay)
Sand
Gravel
Diamicton

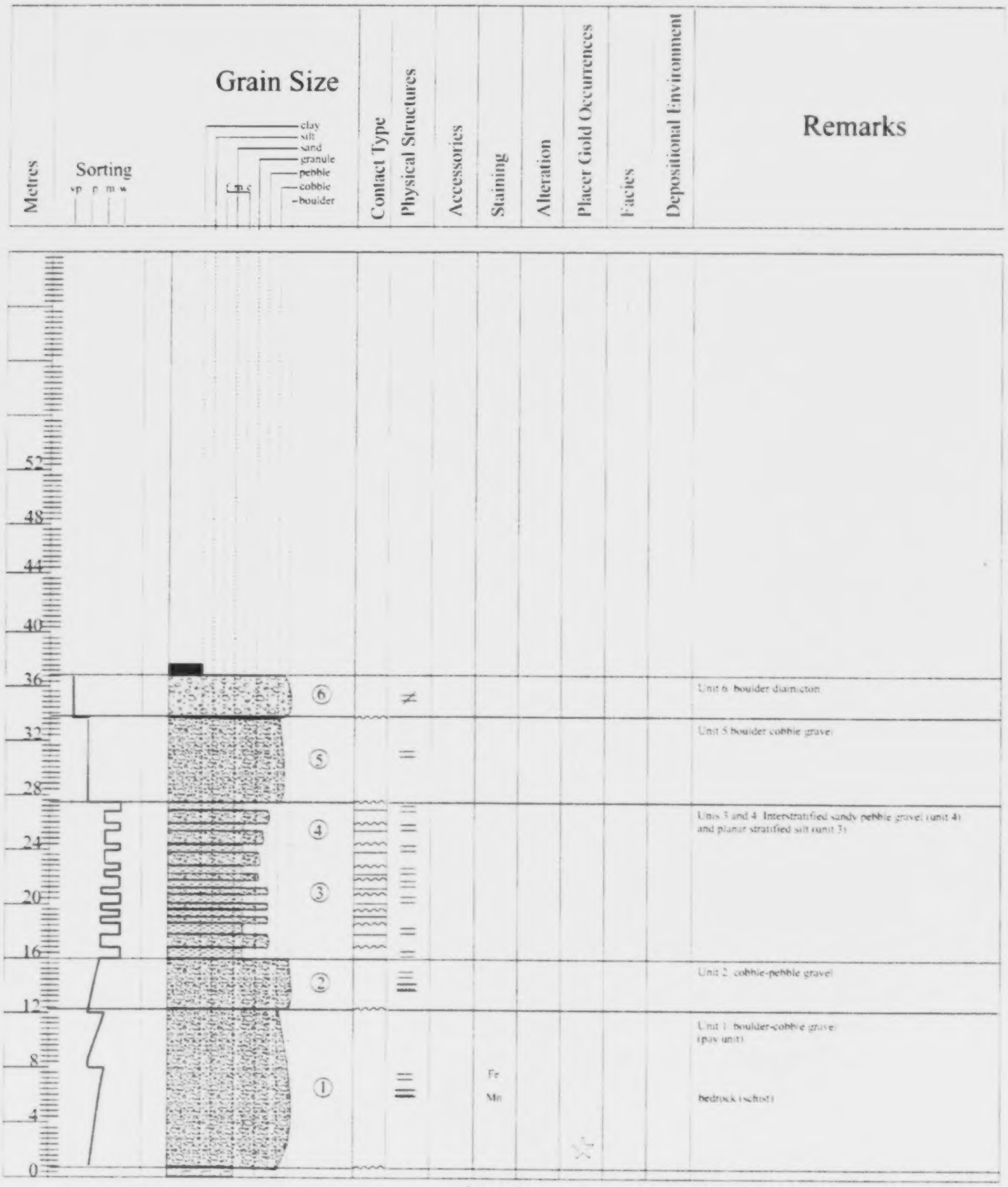
Physical Structures and Accessories

= Planar stratified
≠ Massive
⌒ Ripples
Organics
Cross-stratified
Trough cross-stratified
Fossils

Date: 09 07 95 Section Number: FT2-95 Measured by: WPL Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°48'38"N Longitude: 135°29'04"W Elevation: 2420 ft Geomorphic Landform: Glaciofluvial Terrace
Orientation: 64 <-----------> 244 downstream


Metres
Sorting
Grain Size
clay
silt
sand
granule
pebble
cobble
boulder
Contact Type
Physical Structures
Accessories
Staining
Alteration
Placer Gold Occurrences
Facies
Depositional Environment
Remarks
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
Unit 18: boulder diamicton
Unit 17: planar laminated clay
Unit 16: boulder gravel
Unit 15: ripple laminated silt with ice cast sand wedge pseudomorphs
Unit 14: planar laminated clay
Unit 13: crudely stratified cobble gravel and diamicton with silt interbeds
Unit 12: massive medium sand
Unit 11: ripple laminated fine sand and silt
Unit 10 massive pebble gravel
Unit 9: planar tabular cross-stratified pebbly medium sand
Unit 8: laminated silty clay
Unit 7 crudely stratified imbricate gravel
Covered interval
Unit 6: silty clay
Unit 5: cobble-pebble gravel
Unit 4: silty clay
Unit 3: cobble-pebble gravel
Unit 2: silty clay
Unit 1: boulder-cobble gravel (pay unit)
bedrock (schist)
Wood dated at 32,320 +/- 1270 a B.P.
Fe
Mn
Legend
Lithology
Mud (Silt/clay)
Sand
Gravel
Diamicton
Physical Structures and Accessories
Planar stratified
Cross-stratified
Massive
Trough cross-stratified
Ripples
Organics
Fossils

Date: 09 08 95 Section Number: FT3-95 Measured by: WPL Creek or River: Duncan Creek NTS: 105M14
Latitude: 63 48'43"N Longitude: 135 °29'03"W Elevation: 2420 ft Geomorphic Landform: Glaciofluvial Terrace
Orientation: 20 <------------> 200 downstream



Legend

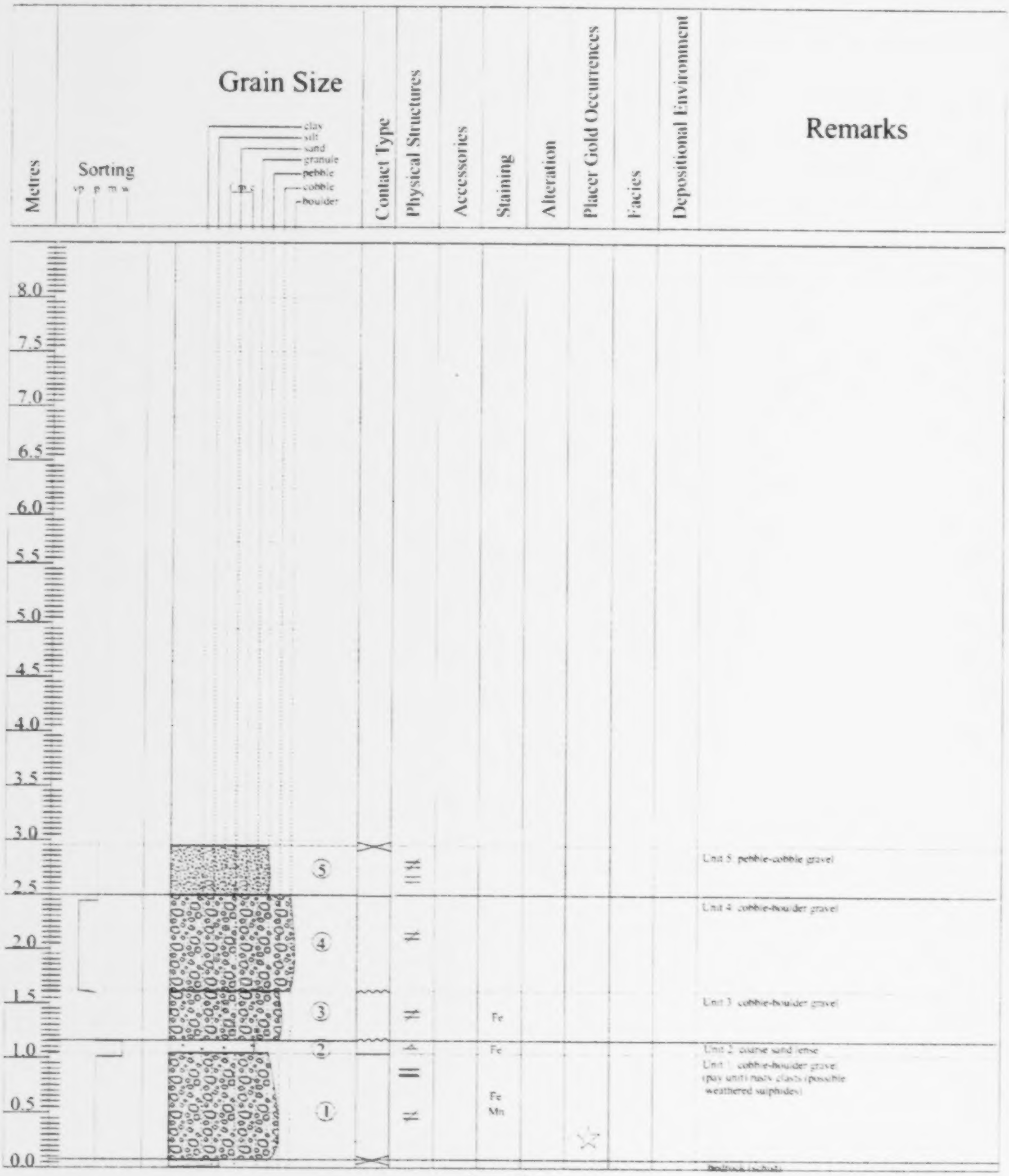
Lithology

☐ Mud (Silt clay)
▨ Gravel
☐ Sand
▨ Diamicton

Physical Structures and Accessories

= Planar stratified
≠ Massive
⌒ Ripples
⅄ Organics
∠ Cross-stratified
⊥ Trough cross-stratified
◡ Fossils

Date: 01/08/95 Section Number: FT4-95 Measured by: WPL/PM Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°48'47"N Longitude: 135°29'00"W Elevation: 2420 Geomorphic Landform: Glaciofluvial Terrace
Orientation: 94 <------------> 274



Legend

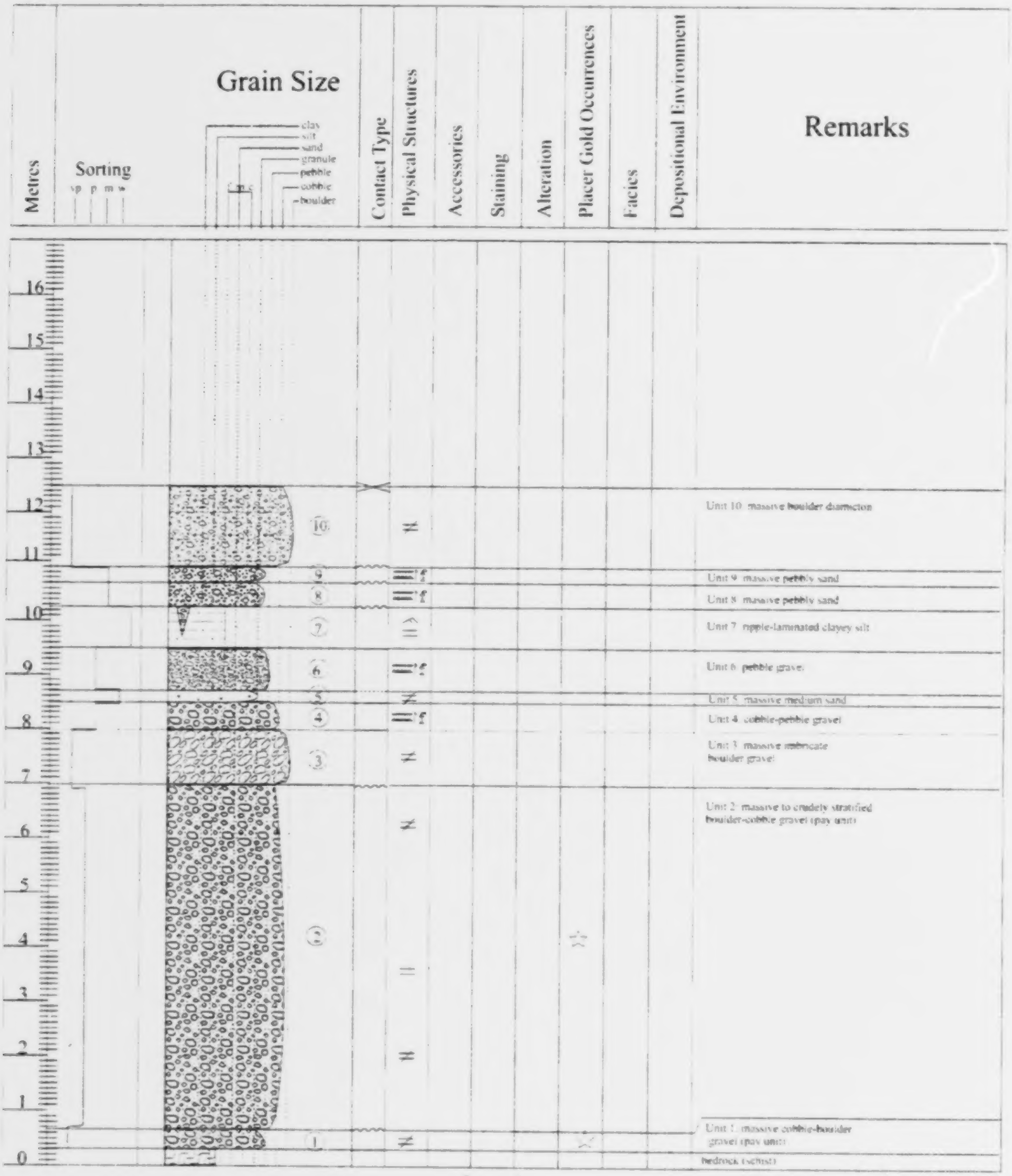
Lithology

Mud (Silt/clay) Gravel
Sand Diamicton

Physical Structures and Accessories

Planar stratified Massive Ripples Organics
Cross-stratified Trough cross-stratified Fossils

Date: 11/08/95 Section Number: FT5-95 Measured by: WPL/PM Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°48'53"N Longitude: 135°28'54"W Elevation: 2450 ft Geomorphic Landform: Glaciofluvial Terrace
Orientation: 34 <------------> 214 Downstream


Metres
Sorting
vp p m w
Grain Size
clay
silt
sand
granule
pebble
cobble
boulder
f m c
Contact Type
Physical Structures
Accessories
Staining
Alteration
Placer Gold Occurrences
Facies
Depositional Environment
Remarks
16
15
14
13
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11
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0
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7
6
5
4
3
2
1
Unit 10: massive boulder diamicton
Unit 9: massive pebbly sand
Unit 8: massive pebbly sand
Unit 7: ripple-laminated clayey silt
Unit 6: pebble gravel
Unit 5: massive medium sand
Unit 4: cobble-pebble gravel
Unit 3: massive imbricate boulder gravel
Unit 2: massive to crudely stratified boulder-cobble gravel (pay unit)
Unit 1: massive cobble-boulder gravel (pay unit)
bedrock (schist)

Legend

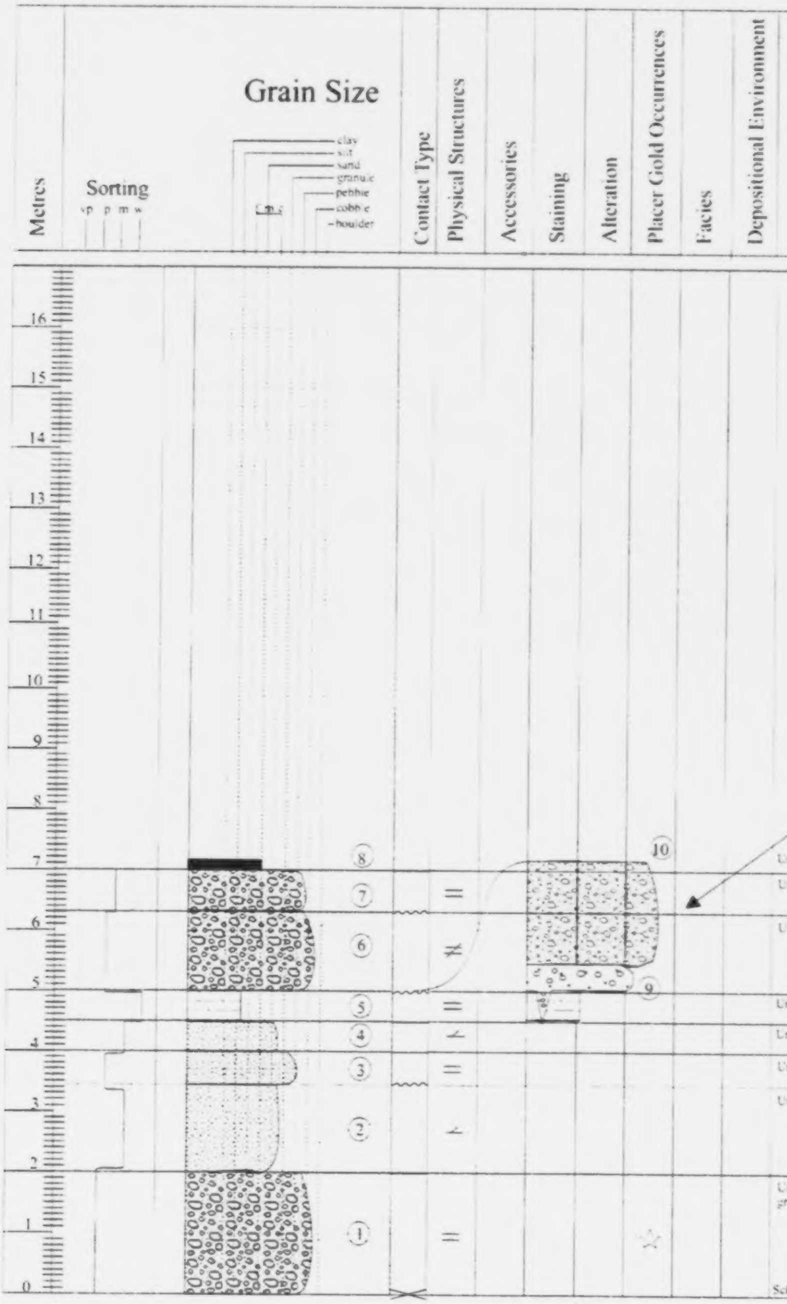
Lithology

- ☐ Mud (Silt/clay)
- ▨ Gravel
- ☐ Sand
- ▨ Diamicton

Physical Structures and Accessories

- = Planar stratified
- ≠ Massive
- ⌒ Ripples
- ⅄ Organics
- ∠ Cross-stratified
- ⌣ Trough cross-stratified
- ◡ Fossils

Date: 28 09 95 Section Number: FT6-95 Measured by: WPL Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°48'53"N Longitude: 135°28'52"W Elevation: 2460 ft Geomorphic Landform: Glaciofluvial Terrace
Orientation: 26 <-----------> 206 Downstream



Remarks

Lateral extension - diamicton (unit 10) overlying pebble gravel (unit 9) with sand wedges developed into unit 5 is incised by units 6 and 7

Unit 8: modern organic layer

Unit 7: crudely stratified cobble-pebble gravel

Unit 6: massive to disorganized boulder-cobble gravel

Unit 5: laminated fine sand and silt

Unit 4: planar tabular cross-bedded medium-coarse sand

Unit 3: sandy pebble gravel

Unit 2: planar tabular cross-bedded medium-coarse sand

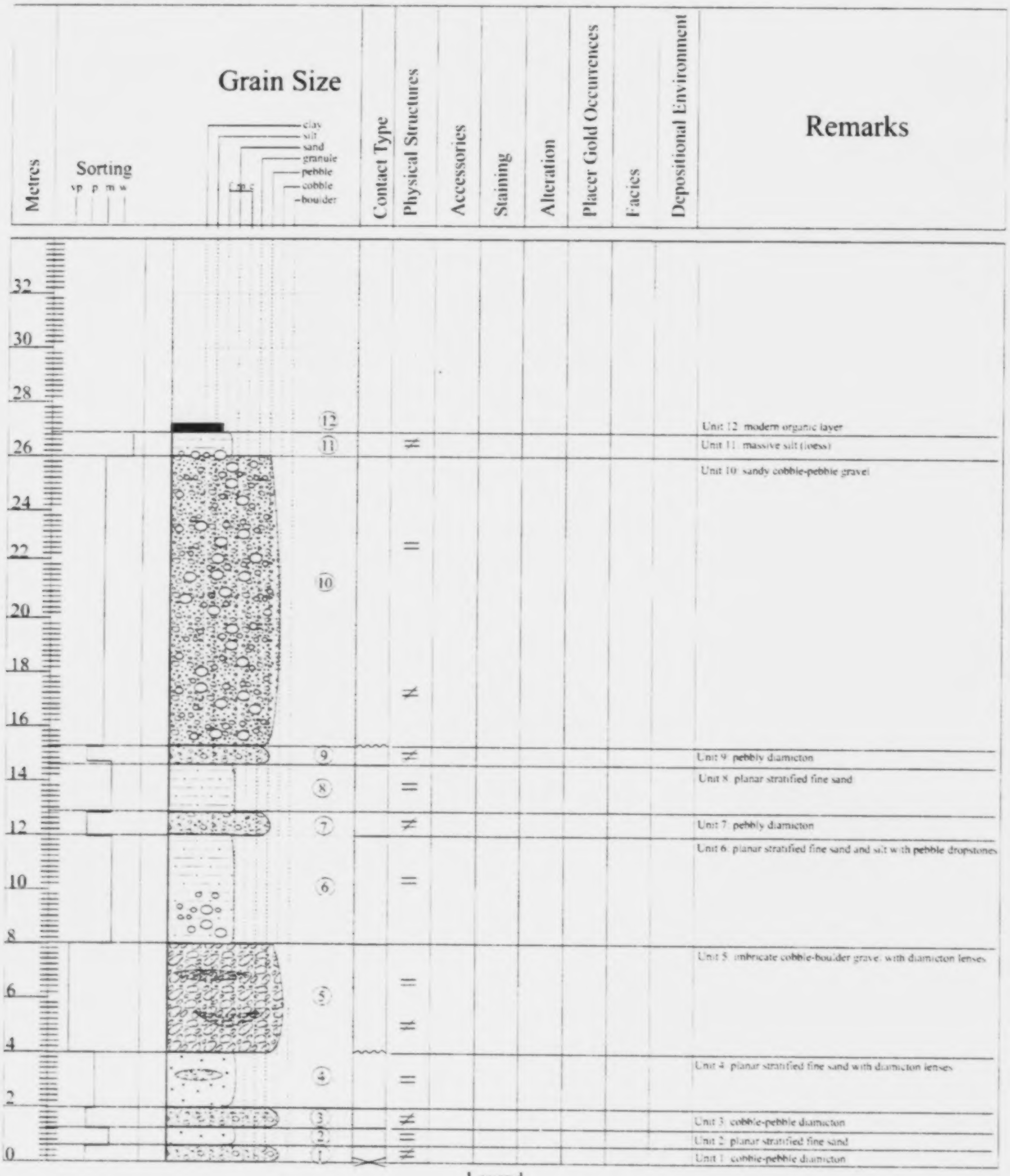
Unit 1: massive to crudely stratified imbricate boulder-cobble gravel (pay unit)

Schist bedrock ten feet below contact

Legend

Lithology		Physical Structures and Accessories			
☐ Mud (Silt/clay)	☐ Gravel	= Planar stratified	≠ Massive	⌒ Ripples	Organics
▨ Sand	▨ Diamicton	∠ Cross-stratified	∠ Trough cross-stratified	⌣ Fossils	

Date: 11/08/95 Section Number: FT7-95 Measured by: WPL Creek or River: Duncan Creek NTS: 105M13
Latitude: 63°47'19"N Longitude: 135 30'21"W Elevation: 2480 Geomorphic Landform: Glaciofluvial Terrace
Orientation: 15 <------------> 195 Downstream



Unit 12: modern organic layer
Unit 11: massive silt (loess)
Unit 10: sandy cobble-pebble gravel
Unit 9: pebbly diamicton
Unit 8: planar stratified fine sand
Unit 7: pebbly diamicton
Unit 6: planar stratified fine sand and silt with pebble dropstones
Unit 5: imbricate cobble-boulder gravel with diamicton lenses
Unit 4: planar stratified fine sand with diamicton lenses
Unit 3: cobble-pebble diamicton
Unit 2: planar stratified fine sand
Unit 1: cobble-pebble diamicton

Legend

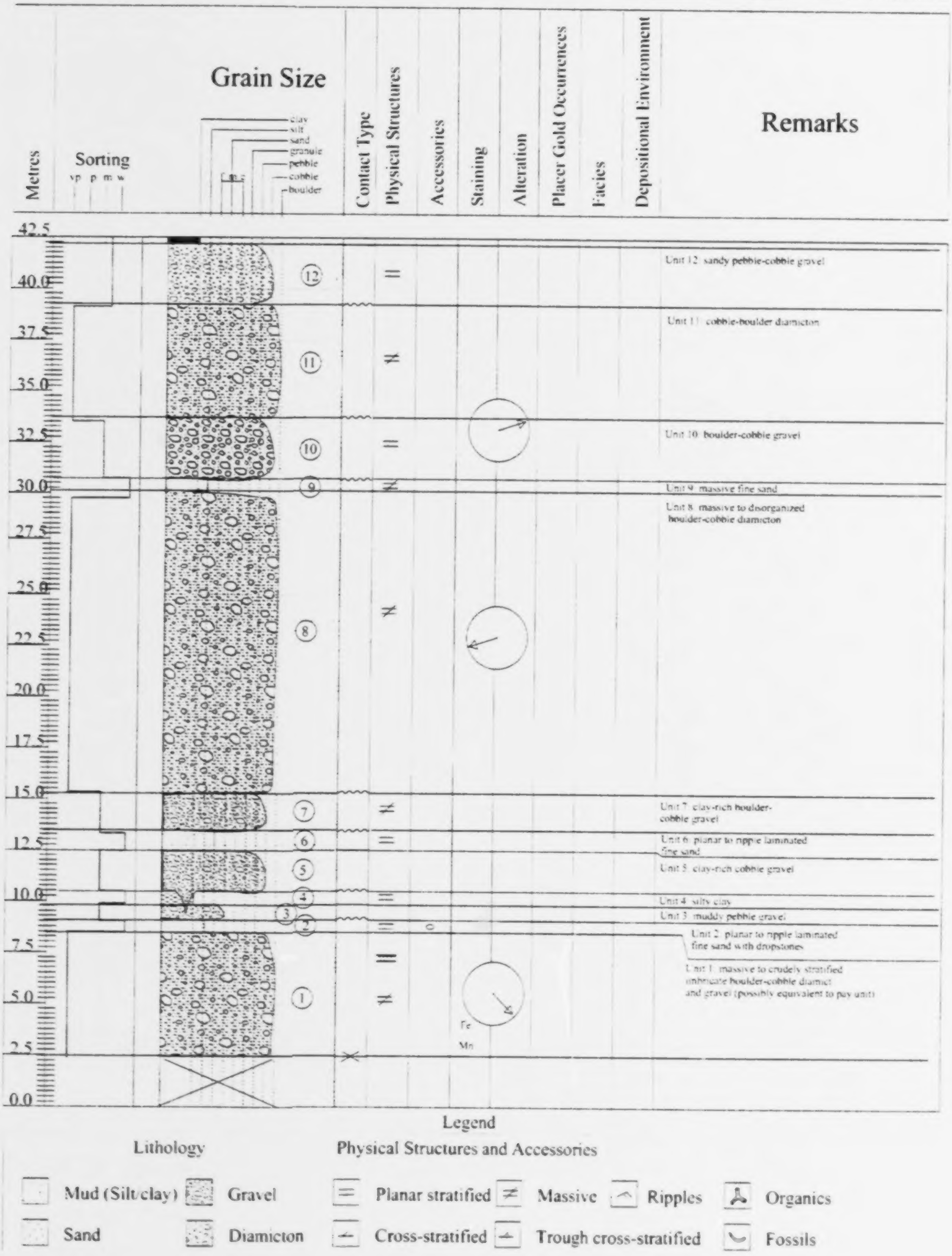
Lithology

☐ Mud (Silt/clay) ▨ Gravel
☐ Sand ▨ Diamicton

Physical Structures and Accessories

= Planar stratified ≠ Massive ⌒ Ripples ⅄ Organics
∠ Cross-stratified ∠ Trough cross-stratified ◡ Fossils

Date: 06/09/95 Section Number: FT8-95 Measured by: WPL Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°47'32"N Longitude: 135°30'03"W Elevation: 2320 Geomorphic Landform: Glaciofluvial Terrace
Orientation: 10 <------------> 190 downstream



Unit 12: sandy pebble-cobble gravel

Unit 11: cobble-boulder diamicton

Unit 10: boulder-cobble gravel

Unit 9: massive fine sand

Unit 8: massive to disorganized boulder-cobble diamicton

Unit 7: clay-rich boulder-cobble gravel

Unit 6: planar to ripple laminated fine sand

Unit 5: clay-rich cobble gravel

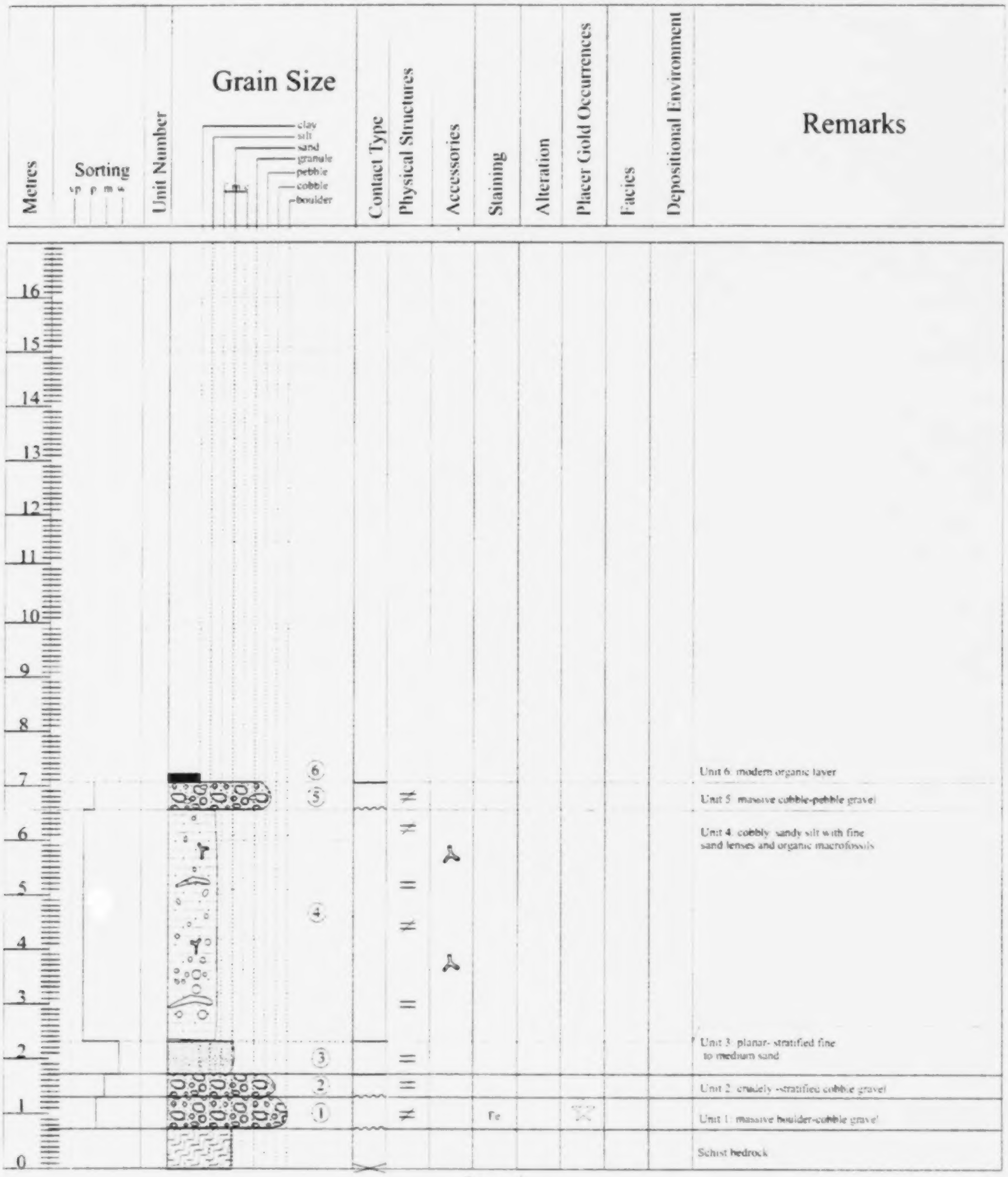
Unit 4: silty clay

Unit 3: muddy pebble gravel

Unit 2: planar to ripple laminated fine sand with dropstones

Unit 1: massive to crudely stratified imbricate boulder-cobble diamict and gravel (possibly equivalent to pay unit)

Date: 19/08/95 Section Number: HB1-95 Measured by: WPL Creek or River: Upper Duncan Creek NTS: 105M14
Latitude: 63°53'03"N Longitude: 135°19'30"W Elevation: 3350 ft Geomorphic Landform: Valley-fill
Orientation: 135 <------------> 315 Downstream



Unit 6: modern organic layer

Unit 5: massive cobble-pebble gravel

Unit 4: cobbly sandy silt with fine sand lenses and organic macrofossils

Unit 3: planar- stratified fine to medium sand

Unit 2: crudely -stratified cobble gravel

Unit 1: massive boulder-cobble gravel

Schist bedrock

Legend

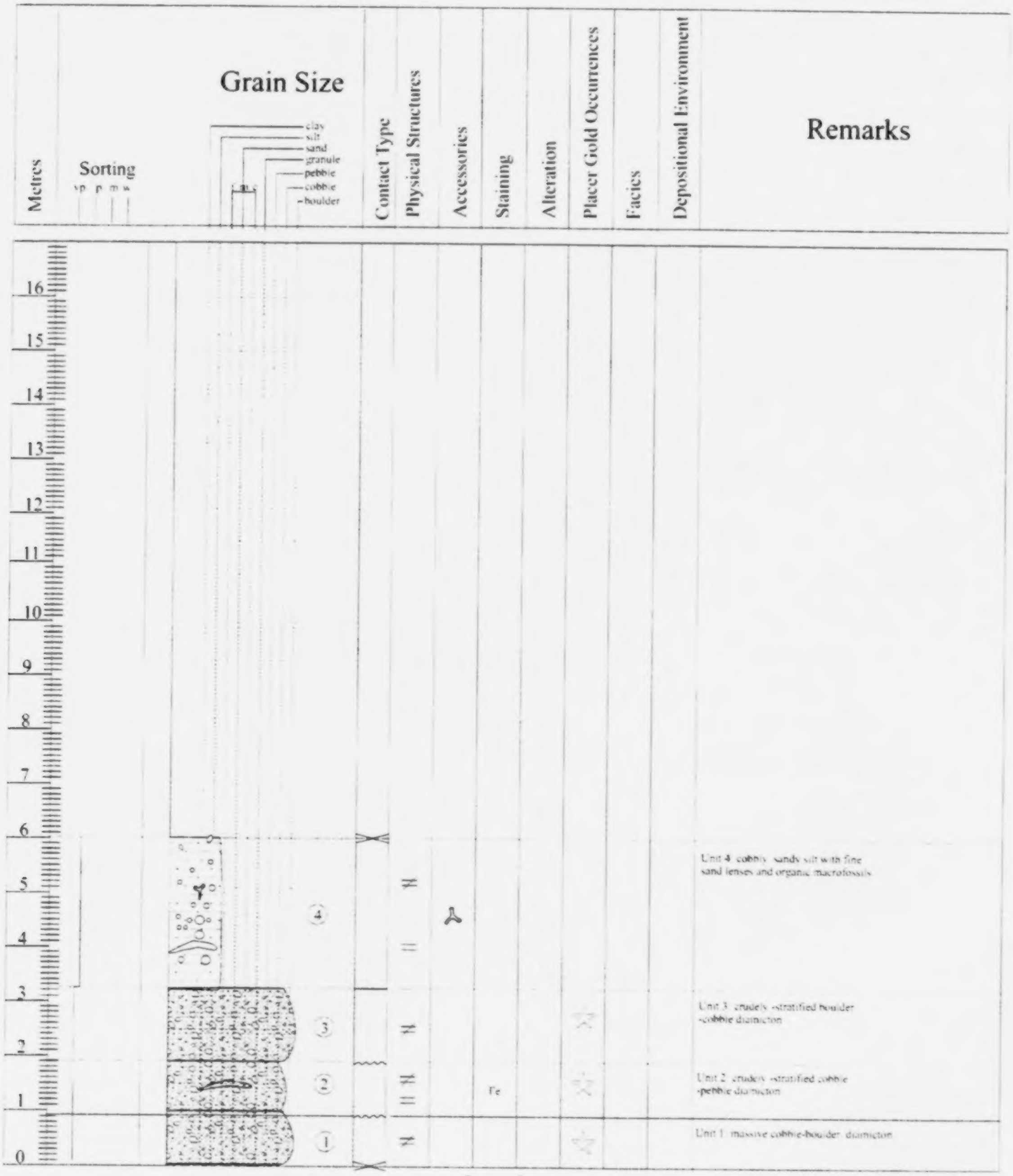
Lithology

- ☐ Mud (Silt/clay)
- ⁚ Gravel
- ░ Sand
- ▒ Diamicton

Physical Structures and Accessories

- = Planar stratified
- ≠ Massive
- ⌒ Ripples
- ⅄ Organics
- ⊥ Cross-stratified
- ⊥ Trough cross-stratified
- ◡ Fossils

Date: 13/09/95 Section Number: HB2-95 Measured by: WPL Creek or River: Upper Duncan Creek NTS: 105M14
Latitude: 63°52'38"N Longitude: 135°18'26"W Elevation: 3220 ft Geomorphic Landform: Valley-fill
Orientation: 020 <------------> 200 Downstream



Unit 4: cobbly, sandy silt with fine sand lenses and organic macrofossils

Unit 3: crudely-stratified boulder-cobble diamicton

Unit 2: crudely-stratified cobble-pebble diamicton

Unit 1: massive cobble-boulder diamicton

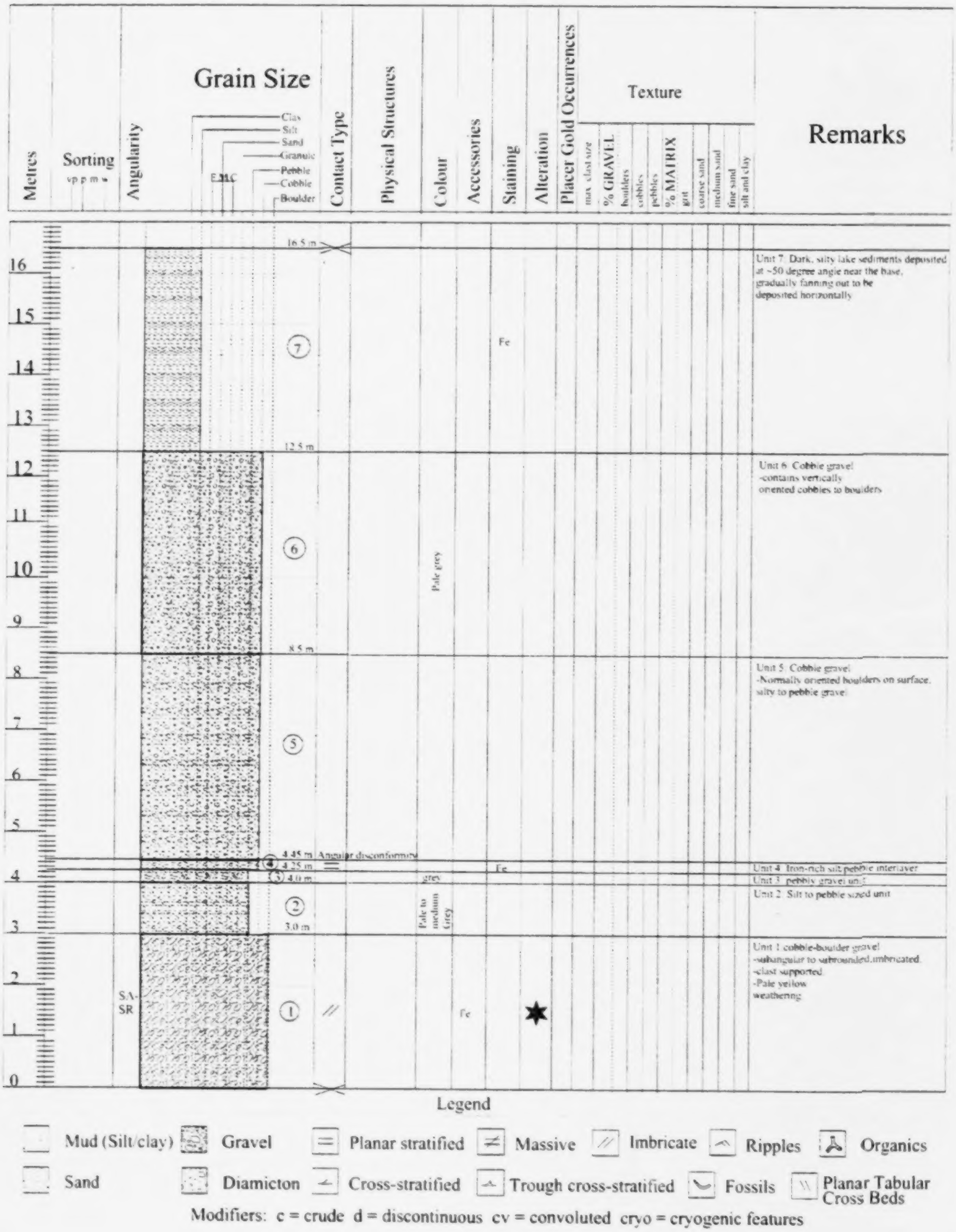
Legend

Lithology		Physical Structures and Accessories			
Mud (Silt/clay)	Gravel	= Planar stratified	Massive	Ripples	Organics
Sand	Diamicton	Cross-stratified	Trough cross-stratified		Fossils

Date: 20/06/96 Section number: LW96-01 Measured by: LW, LM, BL Creek or River: Upper Duncan Creek NTS: 105M14

Latitude: 63°52'61" Longitude: 135°18'36" Elevation: 3225-3250 UTM:

Orientation: 300 ⟷ 120 upstream Geomorphic landform: Valley bottom



Unit 7. Dark, silty lake sediments deposited at ~50 degree angle near the base, gradually fanning out to be deposited horizontally

Unit 6. Cobble gravel
-contains vertically oriented cobbles to boulders

Unit 5. Cobble gravel
-Normally oriented boulders on surface, silty to pebble gravel

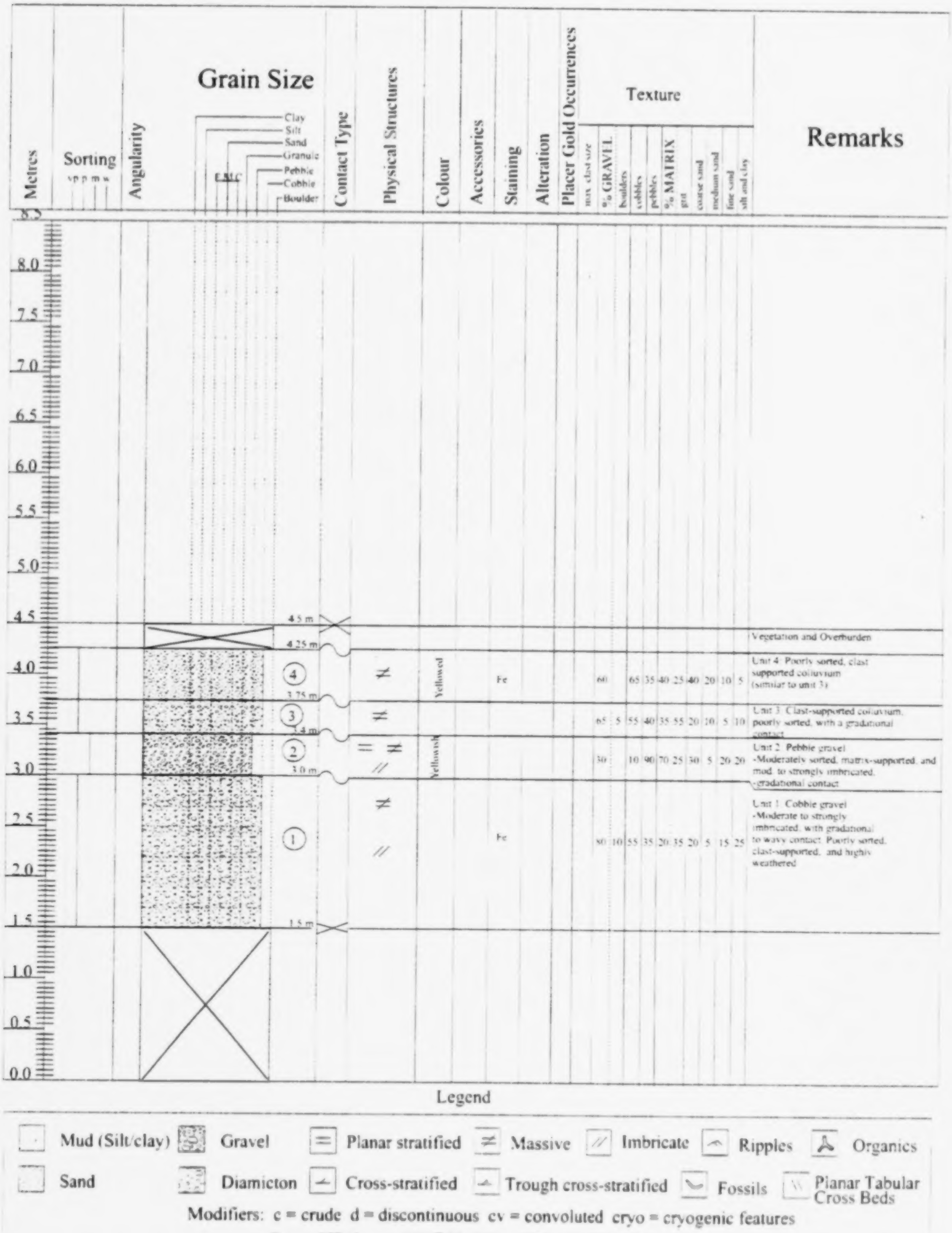
Unit 4. Iron-rich silt pebble interlayer

Unit 3. pebbly gravel unit

Unit 2. Silt to pebble sized unit

Unit 1 cobble-boulder gravel
-subangular to subrounded, imbricated.
-clast supported
-Pale yellow weathering

Date: 06/24/96 Section number: LW-96-03 Measured by: LW LM Creek or River: Upper Duncan Creek NTS: 105M13
Latitude: 63°53.08 Longitude: 135°19.88 Elevation: ______ UTM: _
Orientation: 332 ⟷ 152 upstream Geomorphic landform: Valley



Vegetation and Overburden

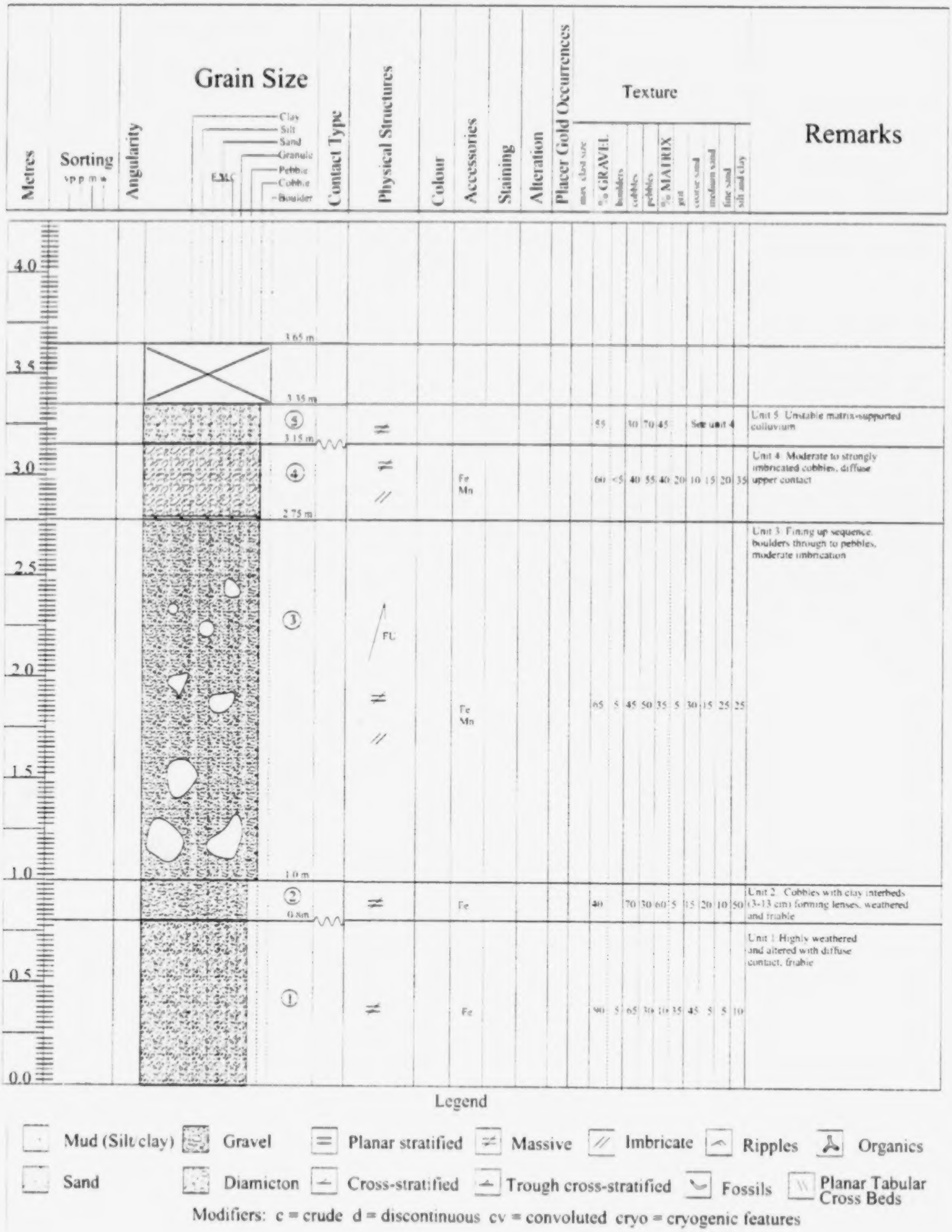
Unit 4: Poorly sorted, clast supported colluvium (similar to unit 3)

Unit 3: Clast-supported colluvium, poorly sorted, with a gradational contact

Unit 2: Pebble gravel
-Moderately sorted, matrix-supported, and mod. to strongly imbricated.
-gradational contact

Unit 1: Cobble gravel
-Moderate to strongly imbricated, with gradational to wavy contact. Poorly sorted, clast-supported, and highly weathered

Date: 25/06/96 Section number: LW96-04 Measured by: LW, LM Creek or River: Upper Duncan Creek unnamed tributary NTS: ________
Latitude: 63°53.05 Longitude: 135°19.83 Elevation: 3030ft UTM: ________
Orientation: 302 ⟷ 122 upstream Geomorphic landform: Valley



Unit 5. Unstable matrix-supported colluvium

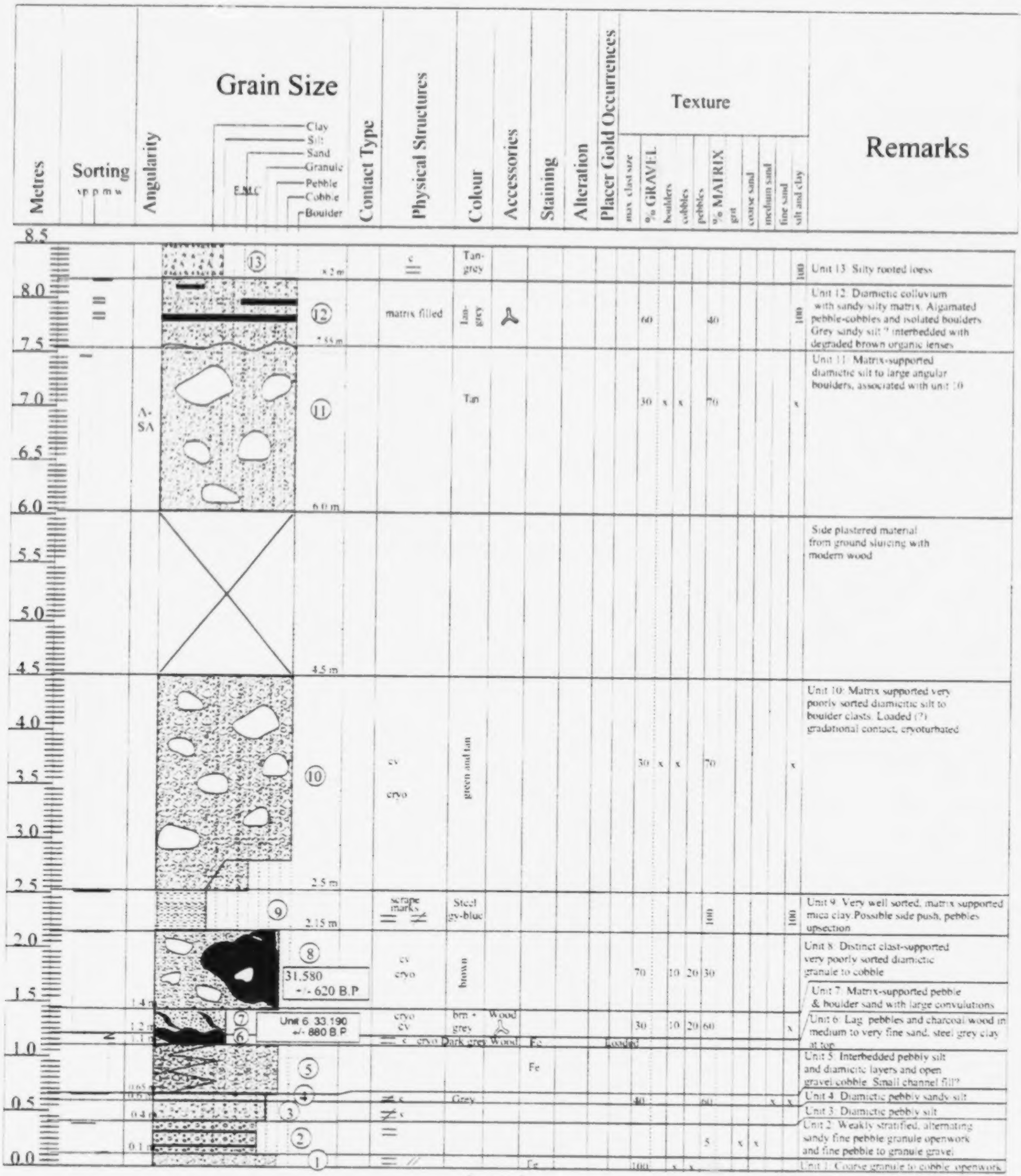
Unit 4. Moderate to strongly imbricated cobbles, diffuse upper contact

Unit 3. Fining up sequence, boulders through to pebbles, moderate imbrication

Unit 2. Cobbles with clay interbeds (3-13 cm) forming lenses, weathered and friable

Unit 1. Highly weathered and altered with diffuse contact, friable

Date 04/07/96 Section number: UD-96-02 Measured by: WPL/MP Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°52.64 Longitude: 135°18.45 Elevation: 3240 ft UTM: 0476570E,7076621N
Orientation: 310 ⟷ 130 upstream Geomorphic landform: Valley



Unit 13: Silty rooted loess

Unit 12: Diamictic colluvium with sandy/silty matrix. Algamated pebble-cobbles and isolated boulders. Grey sandy silt ? interbedded with degraded brown organic lenses

Unit 11: Matrix-supported diamictic silt to large angular boulders, associated with unit 10

Side plastered material from ground sluicing with modern wood

Unit 10: Matrix supported very poorly sorted diamicitic silt to boulder clasts. Loaded (?) gradational contact, cryoturbated

Unit 9: Very well sorted, matrix supported mica clay. Possible side push, pebbles upsection

Unit 8: Distinct clast-supported very poorly sorted diamictic granule to cobble

Unit 7: Matrix-supported pebble & boulder sand with large convulutions

Unit 6: Lag pebbles and charcoal wood in medium to very fine sand, steel grey clay at top

Unit 5: Interbedded pebbly silt and diamicitic layers and open gravel/cobble. Small channel fill?

Unit 4: Diamictic pebbly sandy silt

Unit 3: Diamictic pebbly silt

Unit 2: Weakly stratified, alternating sandy fine pebble/granule openwork and fine pebble to granule gravel

Unit 1: Coarse granule to cobble, openwork

Legend

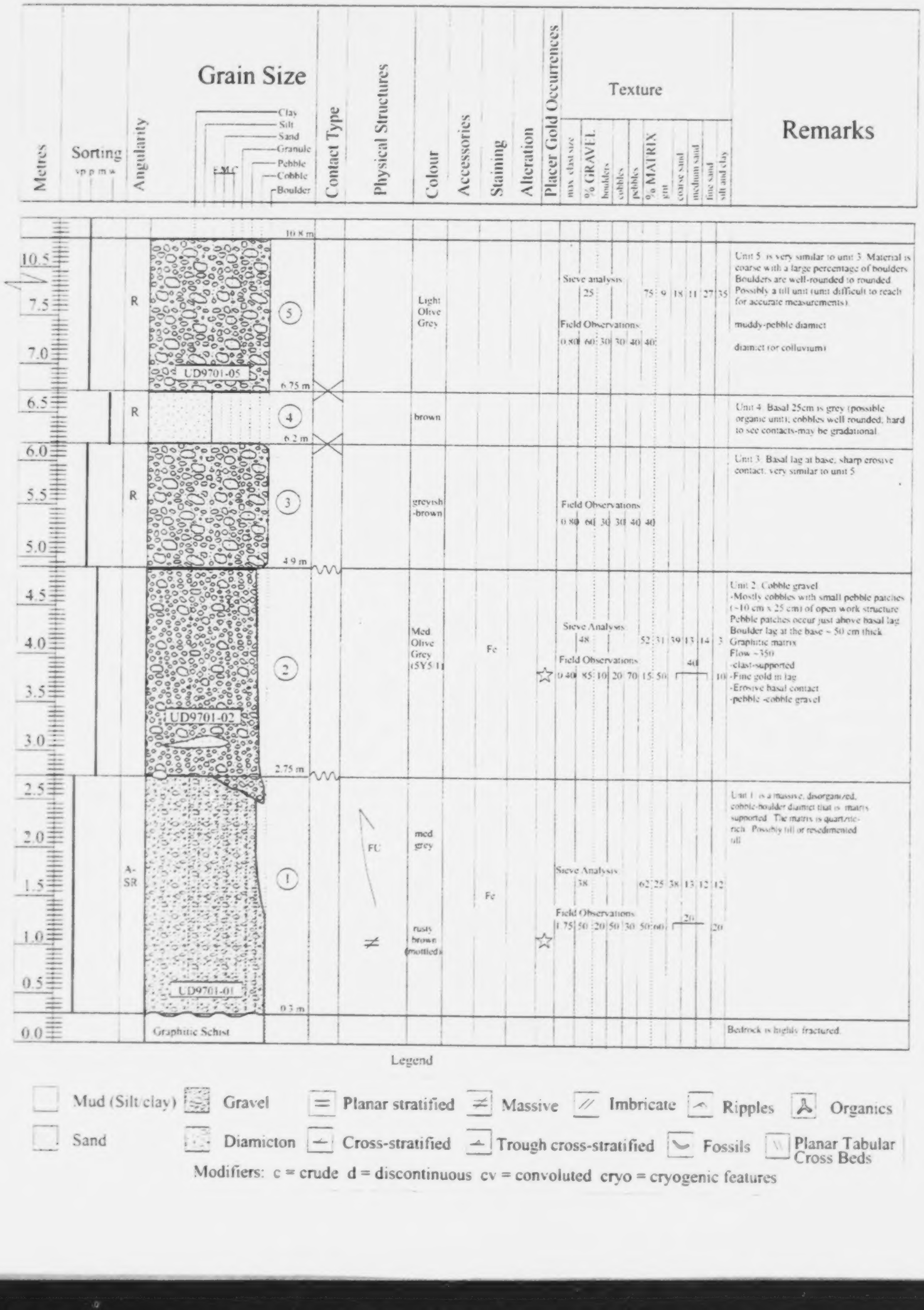
Unit 6: 33,190 +/- 880 B.P

☐ Mud (Silt/clay) ▨ Gravel ☰ Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics
░ Sand ▨ Diamicton ⌐ Cross-stratified ⌐ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

This section is to the north of UD9702, along the cut face, approximately 23 metres away.

Date: 19/06/97 Section number: UD9701 Measured by: TA, WL, EK Creek or River: Upper Duncan Creek NTS: 105 M/14
Latitude: 63°53'22" Longitude: 135°20'29" Elevation: 3000 ft UTM: 483360E, 7084500N
Orientation: 165° ⟷ 345° Geomorphic landform: Alluvial terrace



Unit 5 is very similar to unit 3. Material is coarse with a large percentage of boulders. Boulders are well-rounded to rounded. Possibly a till unit (unit difficult to reach for accurate measurements).

muddy-pebble diamict

diamict (or colluvium)

Unit 4. Basal 25cm is grey (possible organic unit); cobbles well rounded; hard to see contacts-may be gradational.

Unit 3. Basal lag at base, sharp erosive contact, very similar to unit 5

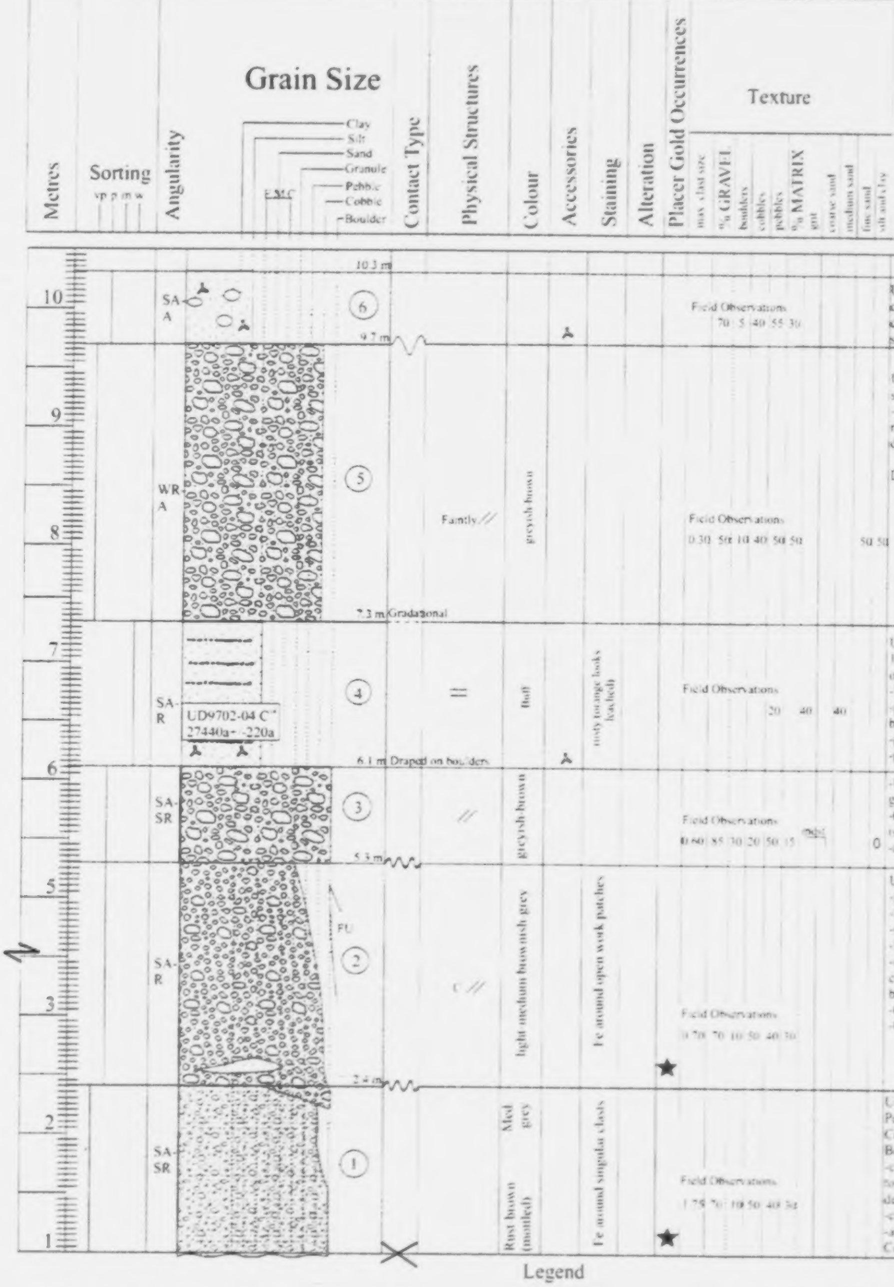
Unit 2. Cobble gravel
-Mostly cobbles with small pebble patches (~10 cm x 25 cm) of open work structure
Pebble patches occur just above basal lag
Boulder lag at the base ~ 50 cm thick
Graphitic matrix
Flow ~350
-clast-supported
-Fine gold in lag
-Erosive basal contact
-pebble -cobble gravel

Unit 1 is a massive, disorganized, cobble-boulder diamict that is matrix supported. The matrix is quartzitic-rich. Possibly till or resedimented till

Bedrock is highly fractured.

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 21/06/97 Section number: Ud9702 Measured by: TA, WL, EK Creek or River: Upper Duncan Creek NTS: 105 M/14
Latitude: 63°53'22" Longitude: 135°20'29" Elevation: 3000 ft. UTM: ________
Orientation: 165 ⟵⟶ 345 Geomorphic landform: Alluvial terrace / valley fill



Remarks

Unit 6: Cobbly silt with organics (3-4 cm thick organic lenses throughout), disorganized, continuous, clasts subangular to angular

Unit 5: sandy matrix (matrix-supported)
-clasts mostly cobbles (well-rounded), pebbles angular, -disorganized, with faint imbrication

Diamict (Colluvium)

Unit 4: laminae of organic material 13 cm from the base (diffuse grey, organic-poor) 3-5 cm thick
-Well-sorted
-pebbly layers (~5 cm) on top and bottom of organic layers
-planar stratified
-pebbly sandstone

-Unit 3: tightly packed open work gravel, imbricated (~north)
-boulders rounded, everything smaller is more angular
-clast-supported

Unit 2: boulder lag
-patches of open-work structure
-lots of grit in matrix
-slightly imbricated
-Few boulders near the top
-clasts angular, flattened, mostly cobbles (50%, subangular), 5-10% boulders (rounded) and rest pebbles
-Clast-supported
-Glacial-Fluvial Gravel

Unit 1: Bouldery-cobble gravel
Pebbles are generally angular
Cobbles = subangular
Boulders = subrounded
-clasts are more angular toward the top, rounder at the base (possible debris flow)
-clast supported at top
-average boulder size 80 cm
Cobble-boulder diamict

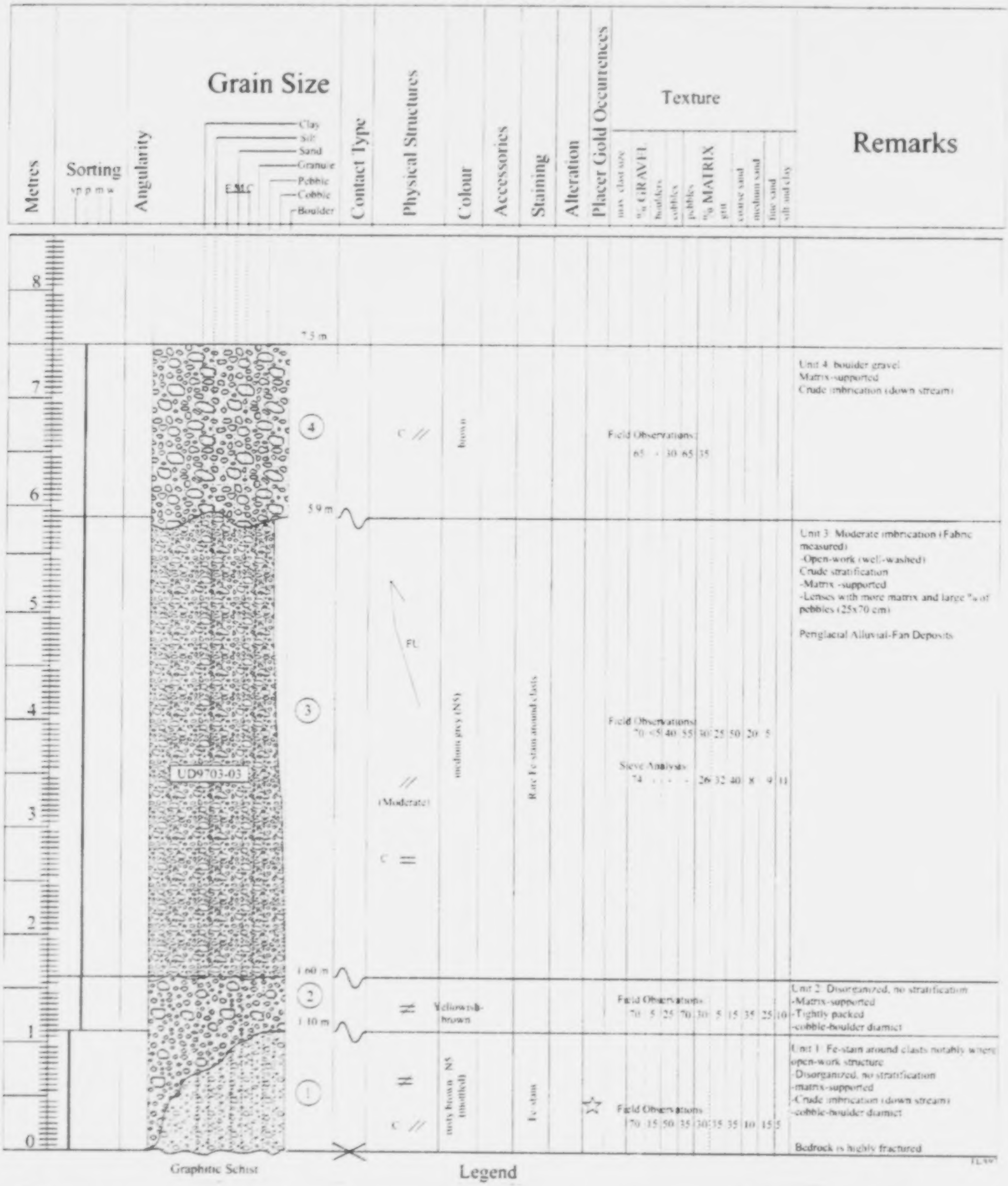
Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics
☐ Sand ▨ Diamicton ∠ Cross-stratified ⌓ Trough cross-stratified ◡ Fossils ▭ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

This section occurs to the south of UD9701, along the cut face, approximately 23 metres apart.

Date: 14/08/97 Section number: UD9703 Measured by: TA, DP Creek or River: Upper Duncan Creek NTS: 105 M/14
Latitude: 63°53'16.9" Longitude: 135°20'14.8" UTM: 483429E, 7084384N Elevation: 3000 ft
Orientation: 150 ⟷ 330 Geomorphic landform: Alluvial terrace



Unit 4: boulder gravel
Matrix-supported
Crude imbrication (down stream)

Unit 3: Moderate imbrication (Fabric measured)
-Open-work (well-washed)
Crude stratification
-Matrix -supported
-Lenses with more matrix and large % of pebbles (25x70 cm)

Periglacial Alluvial-Fan Deposits

Unit 2: Disorganized, no stratification
-Matrix-supported
-Tightly packed
-cobble-boulder diamict

Unit 1: Fe-stain around clasts notably where open-work structure
-Disorganized, no stratification
-matrix-supported
-Crude imbrication (down stream)
-cobble-boulder diamict

Bedrock is highly fractured

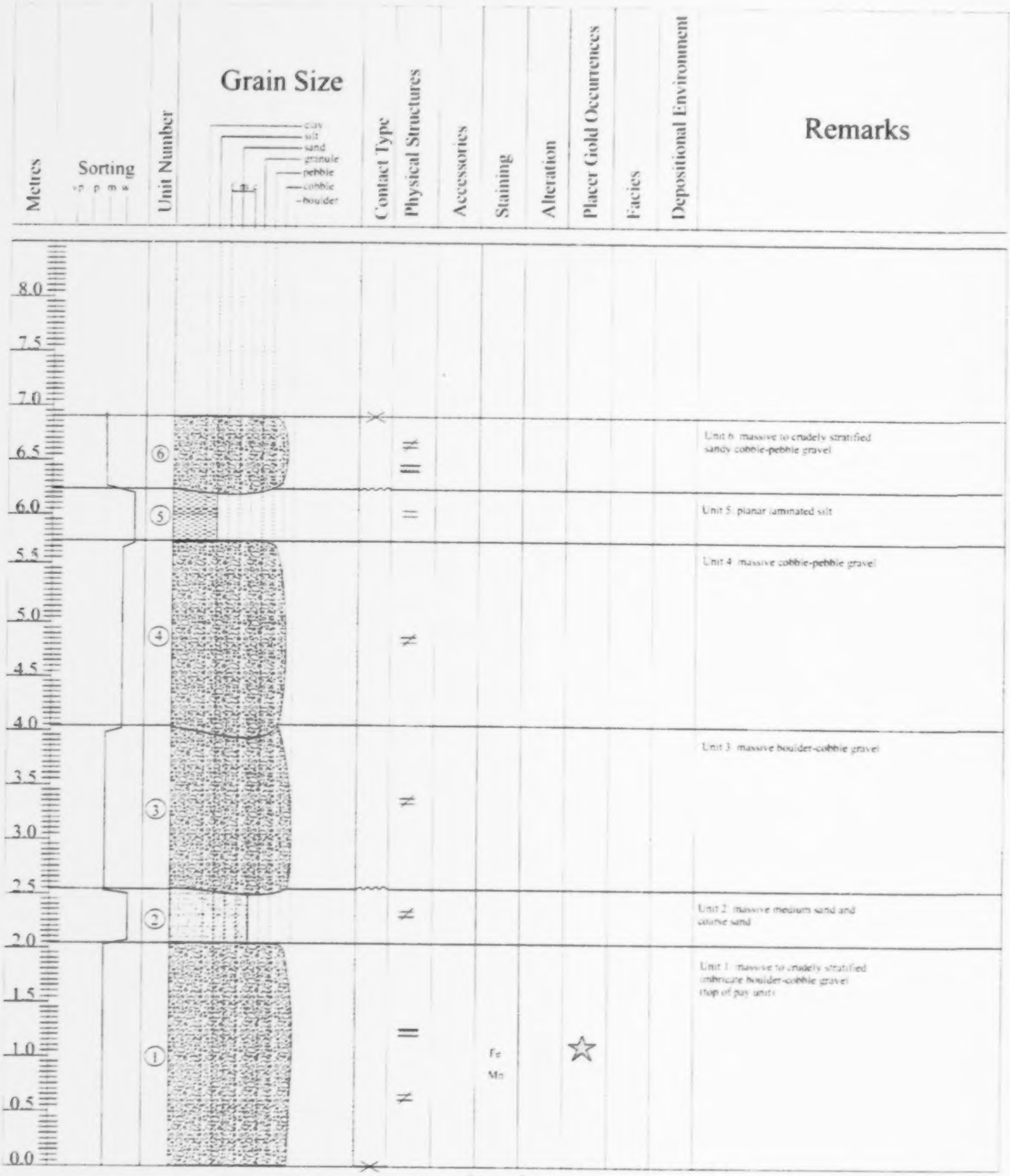
Legend

☐ Mud (Silt clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics
☐ Sand ▨ Diamicton ⊥ Cross-stratified ⊥ Trough cross-stratified ◡ Fossils ☐ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

This section is to the south of UD9702, along the cut face, approximately 100 metres away.

Date: 05/08/96 Section Number: WL9603 Measured by: CW/WL Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°48'53"N Longitude: 135°28'52"W Elevation: 2460 Geomorphic Landform: Glaciofluvial Terrace/Alluvial Valley
Orientation: 20 <------------> 200 downstream



Unit 6: massive to crudely stratified sandy cobble-pebble gravel

Unit 5: planar laminated silt

Unit 4: massive cobble-pebble gravel

Unit 3: massive boulder-cobble gravel

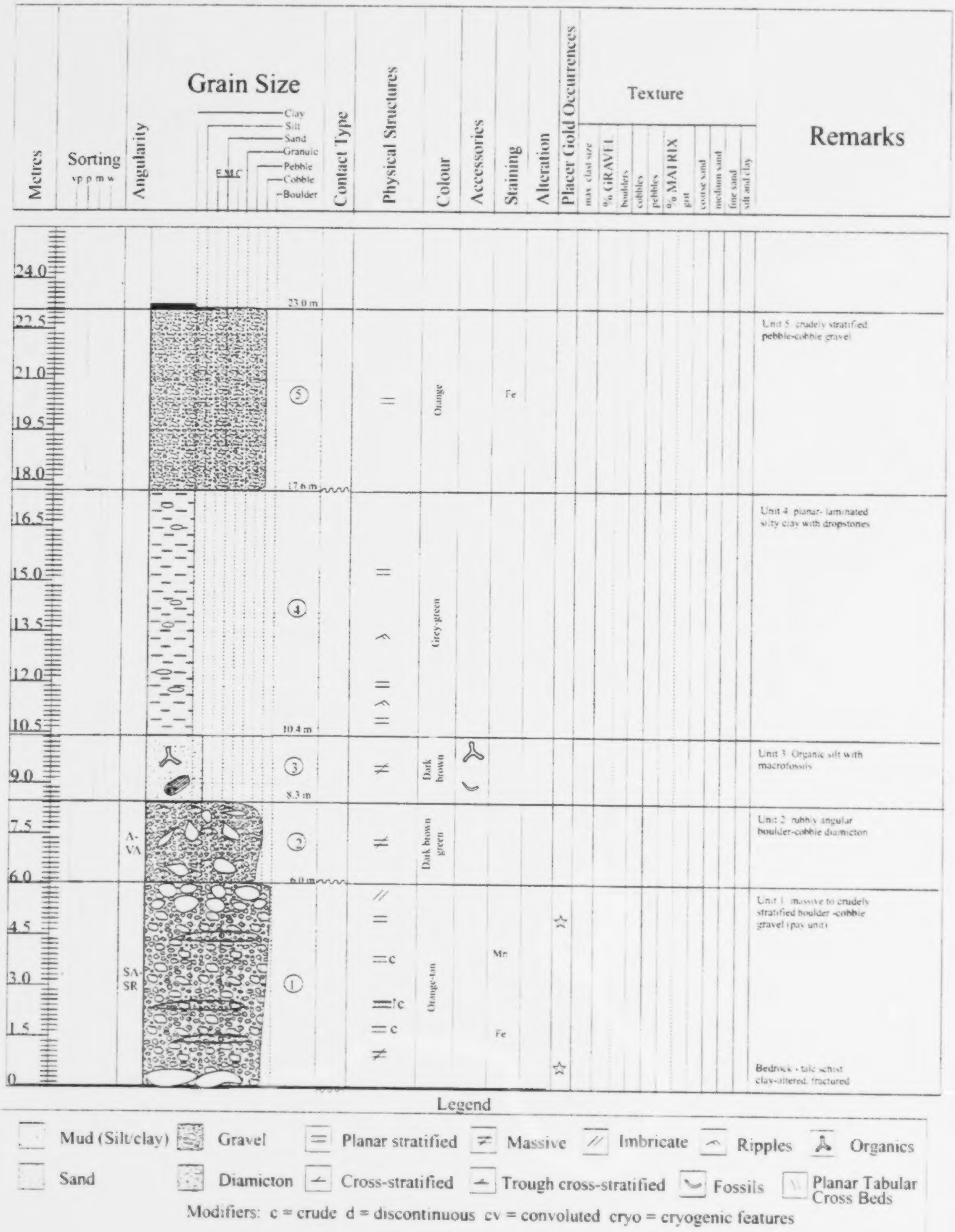
Unit 2: massive medium sand and course sand

Unit 1: massive to crudely stratified imbricate boulder-cobble gravel (top of pay unit)

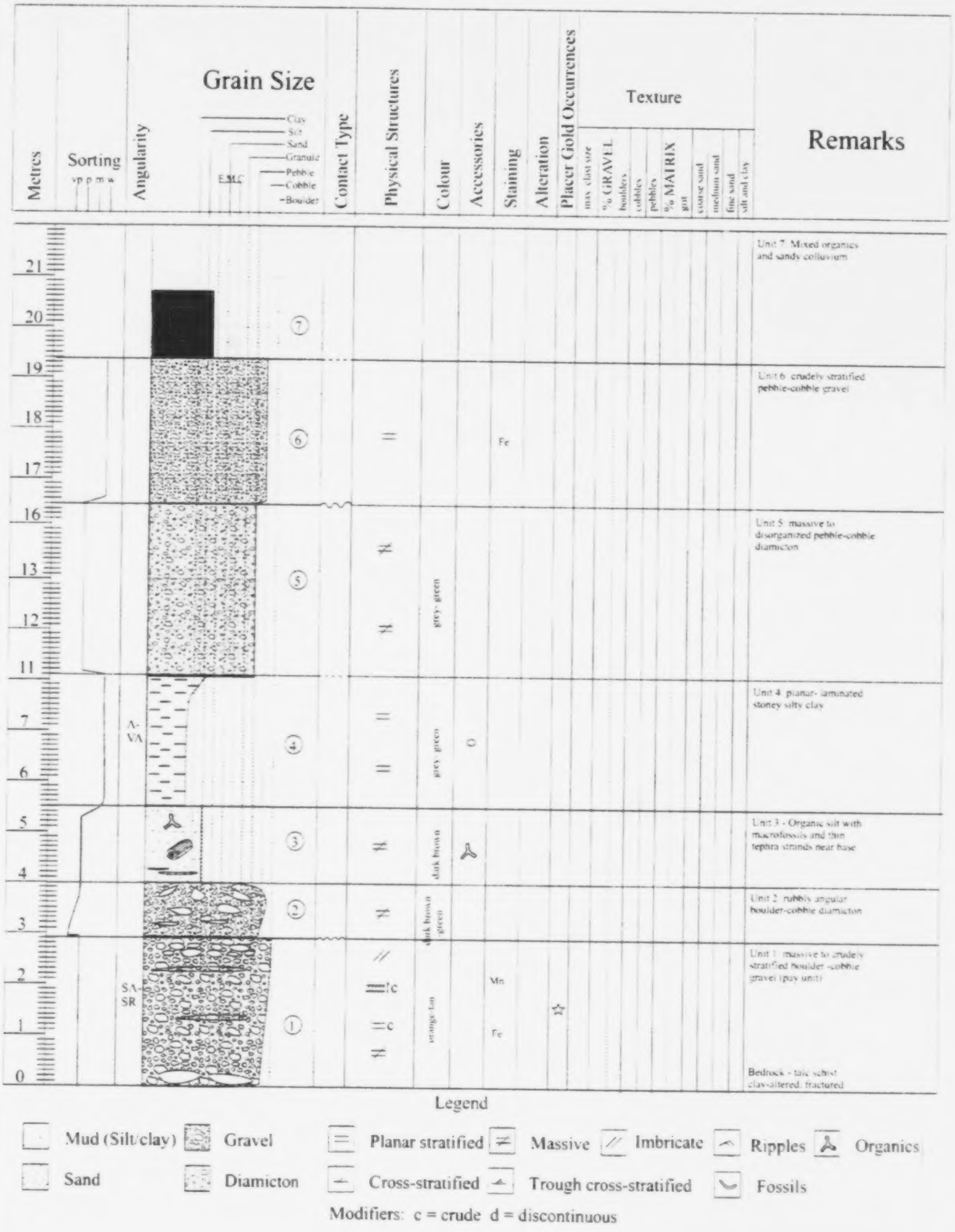
Legend

Lithology		Physical Structures and Accessories			
▒ Mud (Silt/clay)	▒ Gravel	= Planar stratified	≠ Massive	⌒ Ripples	Organics
☐ Sand	▒ Diamicton	∠ Cross-stratified	⌣ Trough cross-stratified		Fossils

Date: 05/08/98 Section number: FT98-1-1 Measured by: WPL MR Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°49'05"N Longitude: 135° 28'30"W Elevation: 2480 UTM: 0476570E,7076621N
Orientation: 200 ⟷ 20 upstream Geomorphic landform: Glaciofluvial Terrace



Date: 05/08/98 Section number: FT98-1-2 Measured by: WPL/MR Creek or River: Duncan Creek NTS: 105M14
Latitude: 63°49'05"N Longitude: 135°28'30"W Elevation: 2480 ft UTM: 0476570E,7076621N
Orientation: 200 ⟷ 20 upstream Geomorphic landform: Glaciofluvial Terrace



Unit 7: Mixed organics and sandy colluvium

Unit 6: crudely stratified pebble-cobble gravel

Unit 5: massive to disorganized pebble-cobble diamicton

Unit 4: planar- laminated stoney silty clay

Unit 3 - Organic silt with macrofossils and thin tephra strands near base

Unit 2: rubbly angular boulder-cobble diamicton

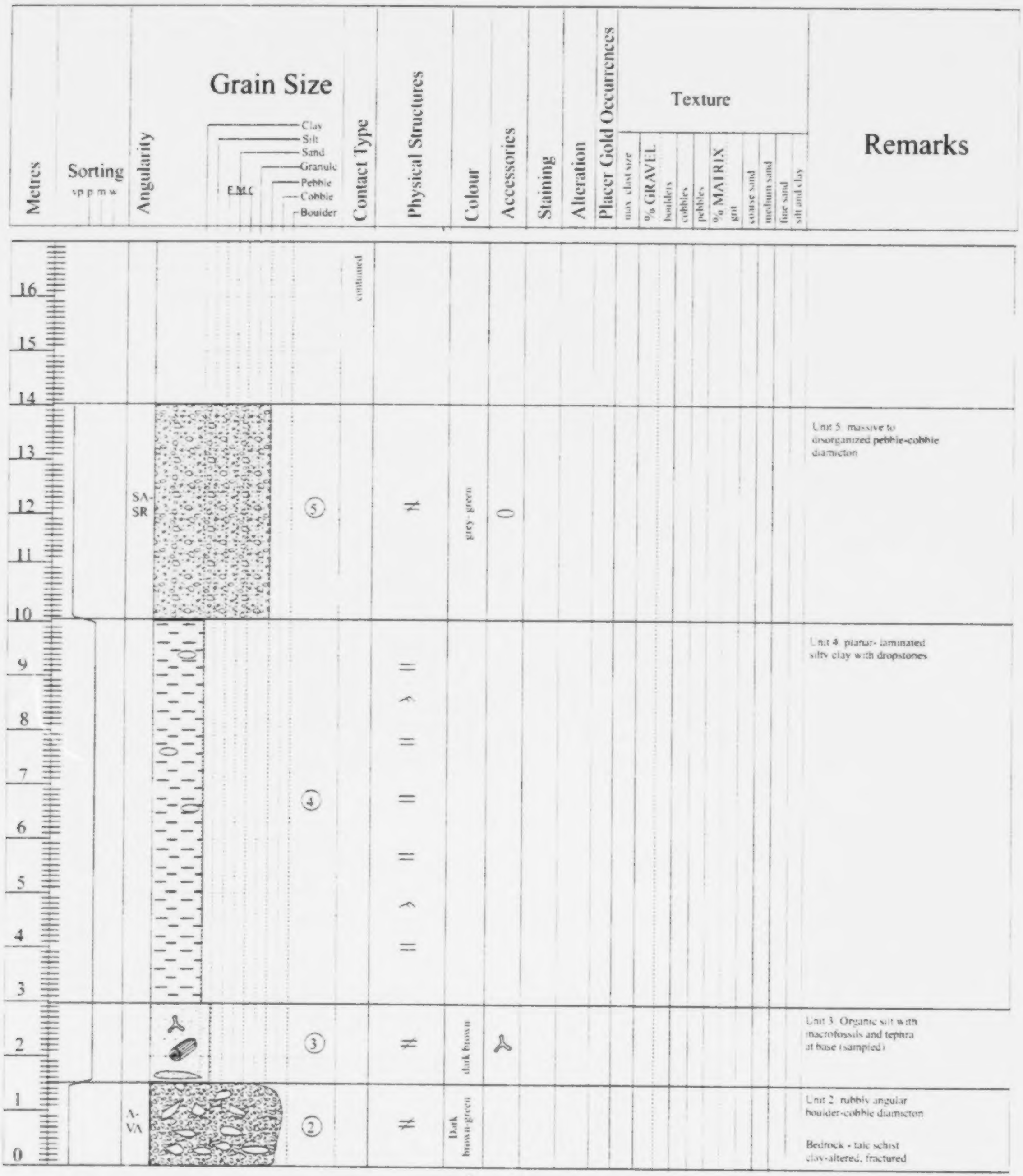
Unit 1: massive to crudely stratified boulder -cobble gravel (pay unit)

Bedrock - talc schist clay-altered, fractured

Date: 05/08/98 Section number: FT98-1-3 Measured by: WPL/MR Creek or River: Duncan Creek NTS: 105M14

Latitude: 63°49'05"N Longitude: 135°28'30"W Elevation: 2480 UTM: 0476570E,7076621N

Orientation: 273 ⟷ 93 cross-valley Geomorphic landform: Glaciofluvial Terrace



Unit 5: massive to disorganized pebble-cobble diamicton

Unit 4: planar- laminated silty clay with dropstones

Unit 3: Organic silt with macrofossils and tephra at base (sampled)

Unit 2: rubbly angular boulder-cobble diamicton

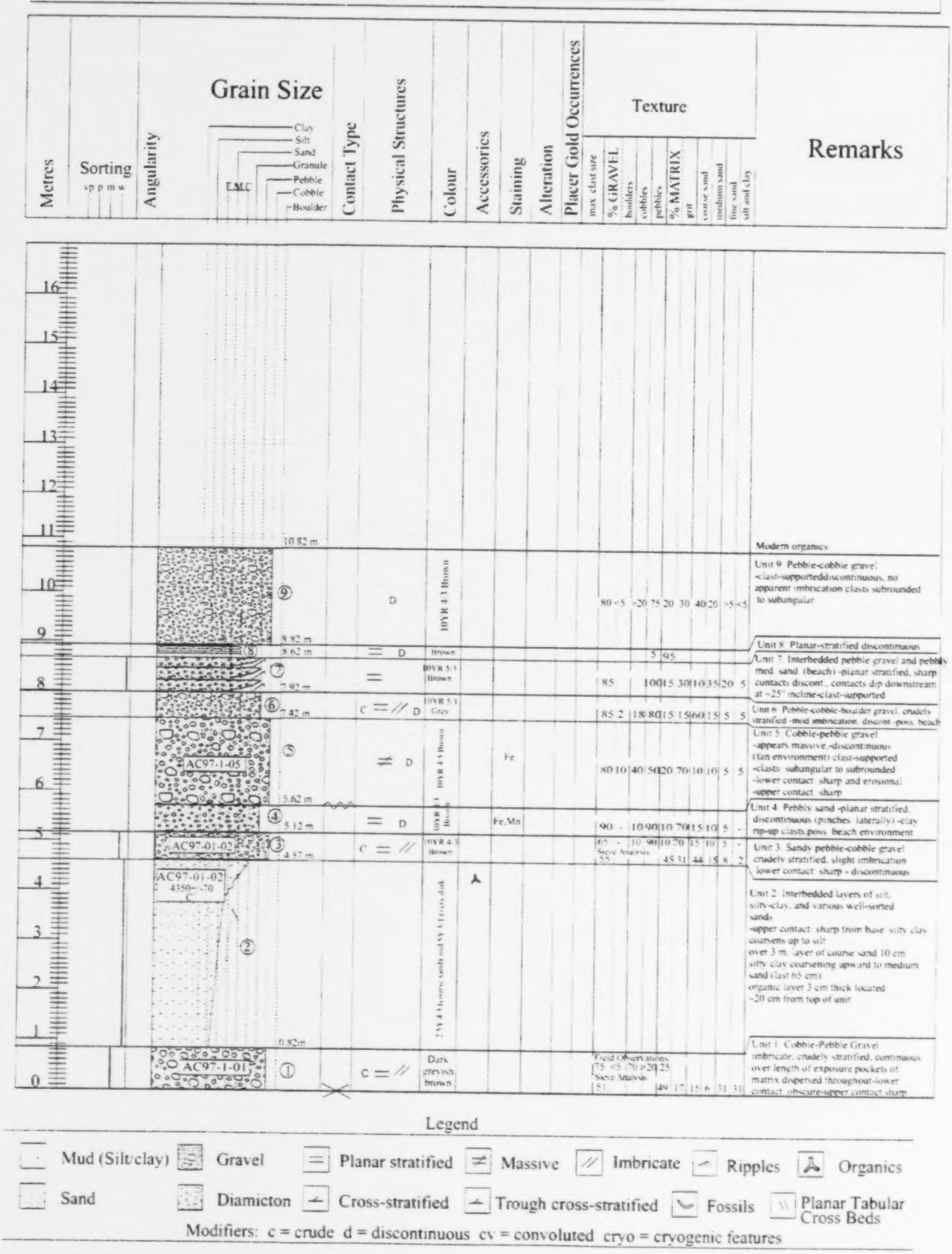
Bedrock - talc schist clay-altered, fractured

Legend

☐	Mud (Silt/clay)	▨	Gravel	=	Planar stratified	≠	Massive	//	Imbricate	⌒	Ripples
☐	Sand	▨	Diamicton	∠	Cross-stratified	⊥	Trough cross-stratified	◡	Fossils	人	Organics

Modifiers: c = crude d = discontinuous

Date: 02/07/1997 Section number: AC9701 Measured by: WL, DM Creek or River: Anderson Creek NTS: 105M/11
Latitude: 63°43.78' Longitude: 135°01.54' Elevation: 2320 ft UTM: 498703, 7066649
Orientation: 025° ⟷ 205° Geomorphic landform: Alluvial-fan Delta



Modern organics

Unit 9 Pebble-cobble gravel
-clast-supporteddiscontinuous, no apparent imbrication clasts subrounded to subangular

Unit 8 Planar-stratified discontinuous

Unit 7 Interbedded pebble gravel and pebbly med. sand (beach) -planar stratified, sharp contacts discont., contacts dip downstream at ~25° incline-clast-supported

Unit 6 Pebble-cobble-boulder gravel, crudely stratified -mod imbrication, discont -poss. beach

Unit 5 Cobble-pebble gravel
-appears massive,-discontinuous (fan environment) clast-supported
-clasts: subangular to subrounded
-lower contact: sharp and erosional
-upper contact: sharp

Unit 4 Pebbly sand -planar stratified, discontinuous (pinches laterally) -clay rip-up clasts,poss. beach environment

Unit 3 Sandy pebble-cobble gravel crudely stratified, slight imbrication lower contact: sharp - discontinuous

Unit 2 Interbedded layers of silt, silty-clay, and various well-sorted sands
-upper contact: sharp from base: silty clay coarsens up to silt
over 3 m. layer of coarse sand 10 cm silty clay coarsening upward to medium sand (last 65 cm)
organic layer 3 cm thick located ~20 cm from top of unit

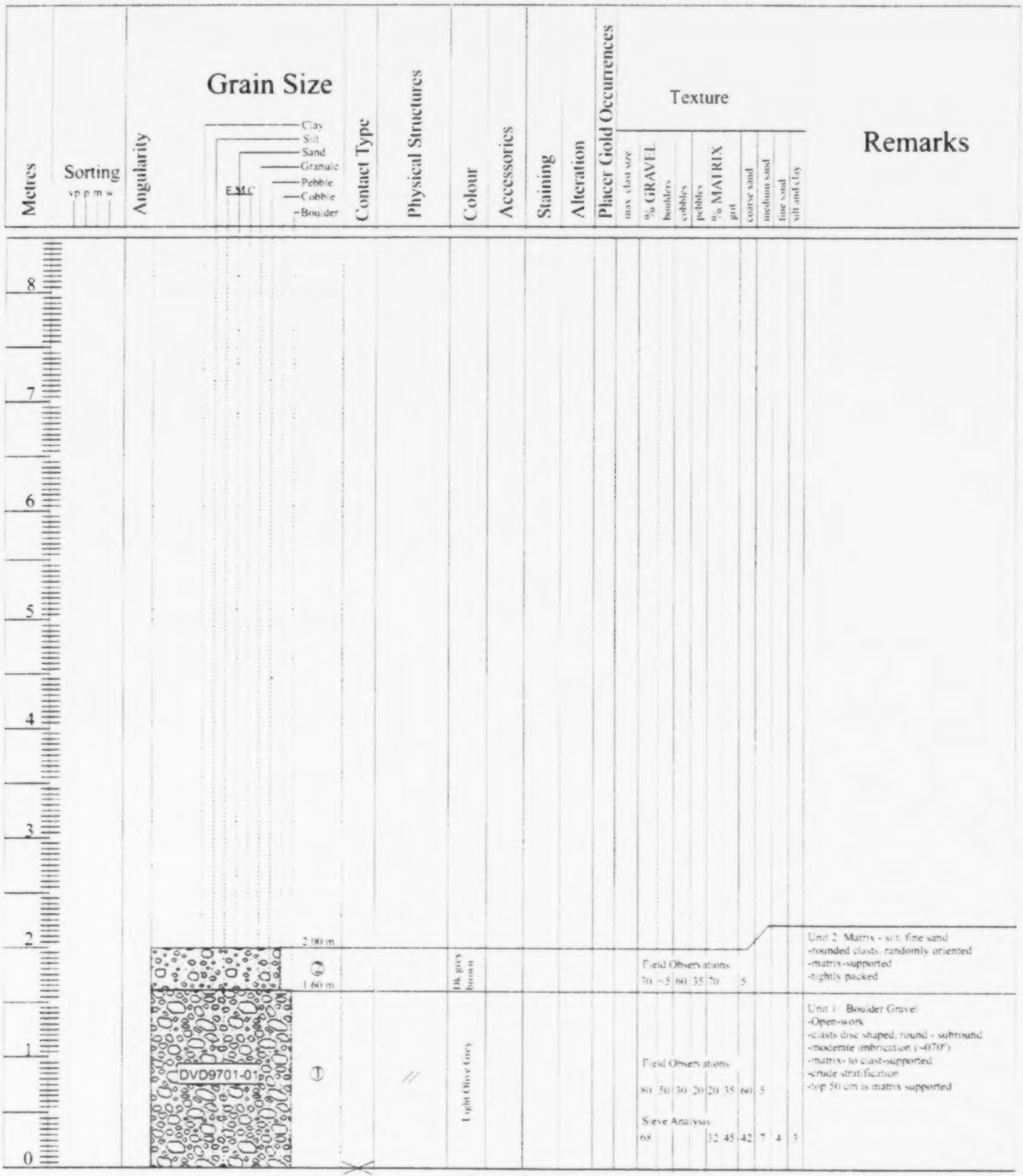
Unit 1 Cobble-Pebble Gravel imbricate, crudely stratified, continuous over length of exposure pockets of matrix dispersed throughout-lower contact: obscure-upper contact sharp

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 16/08/97 Section number: DVD9701 Measured by: TA, DP Creek or River: Davidson Creek NTS: 105M/11

Latitude: 63°43'46.2" Longitude: 135°25'05.0" UTM: N7066742, E0479353 Elevation: ~2600 ft

Orientation: 075 ⟷ 255 Geomorphic landform: ______



Field Observations
30 ~5 | 60 35 | 70 5

Unit 2: Matrix - silt, fine sand
-rounded clasts, randomly oriented
-matrix-supported
-tightly packed

Field Observations
80 | 50 | 30 20 | 20 35 | 60 | 5

Sieve Analysis
68 | 32 45 | 42 | 7 | 4 | 3

Unit 1: Boulder Gravel
-Open-work
-clasts disc shaped, round - subround
-moderate imbrication (~070°)
-matrix- to clast-supported
-crude stratification
-top 50 cm is matrix supported

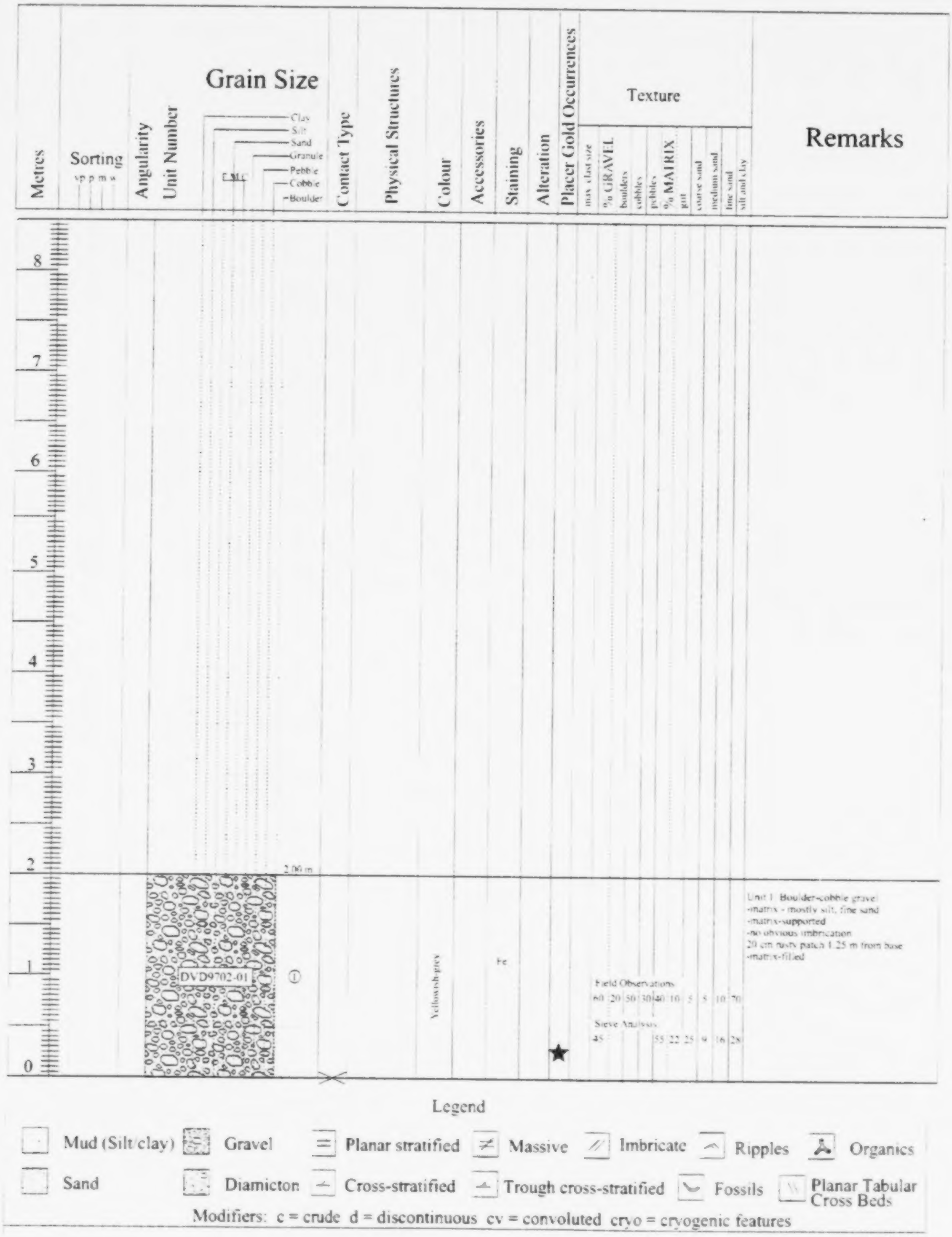
Legend

☐ Mud (Silt/clay) ▨ Gravel ☰ Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics

☐ Sand ▨ Diamicton ⊣ Cross-stratified ⊥ Trough cross-stratified ◡ Fossils ⧅ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

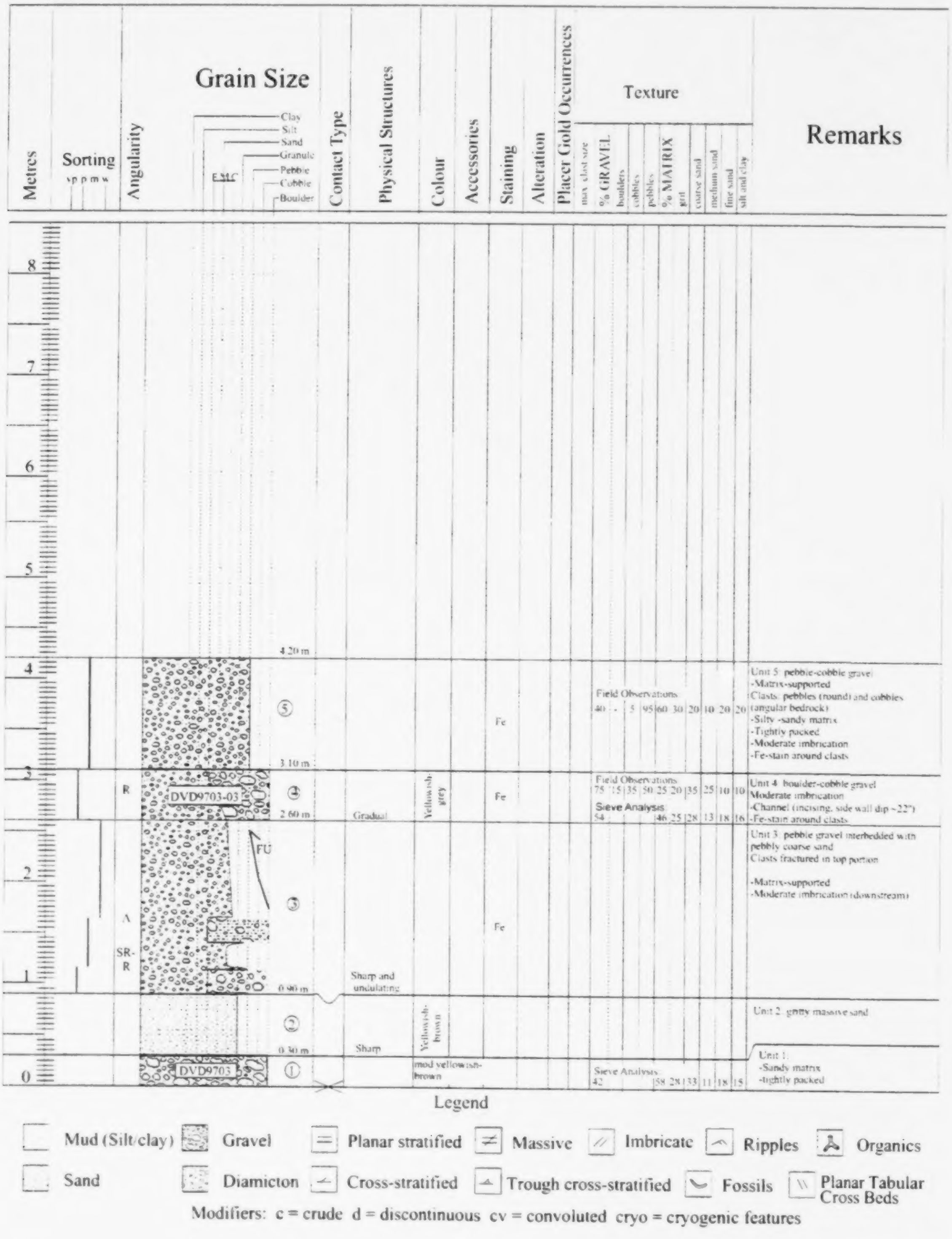
Date: 16/08/97 Section number: DVD9702 Measured by: TA, DP Creek or River: Davidson Creek NTS: 105M/11
Latitude: 63°43'51.3" Longitude: 135°25'09.0" UTM: N7066910, E0479322 Elevation: ~2600 ft
Orientation: 015° ↔ 195° Geomorphic landform: ____



Unit 1: Boulder-cobble gravel
-matrix - mostly silt, fine sand
-matrix-supported
-no obvious imbrication
20 cm rusty patch 1.25 m from base
-matrix-filled

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 29/08/97 Section number: DVD9703 Measured by: TA/DP Creek or River: Davidson Creek NTS 105M / 11
Latitude: 63°43'51" N Longitude: 135°25'7.2" UTM: 479325E 7066891N Elevation: 2400 ft
Orientation: 330° DS ⟷ 150° US Geomorphic landform: Valley fill



Unit	Data	max clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay
5	Field Observations	40	-		5	95	60	30	20	10	20	20
4	Field Observations	75	15	35	50	25	20	35	25	10	10	
4	Sieve Analysis	54				46	25	28	13	18	16	
1	Sieve Analysis	42				58	28	33	11	18	15	

Unit 5: pebble-cobble gravel
-Matrix-supported
Clasts: pebbles (round) and cobbles (angular bedrock)
-Silty -sandy matrix
-Tightly packed
-Moderate imbrication
-Fe-stain around clasts

Unit 4: boulder-cobble gravel
Moderate imbrication
-Channel (incising, side wall dip ~22°)
-Fe-stain around clasts

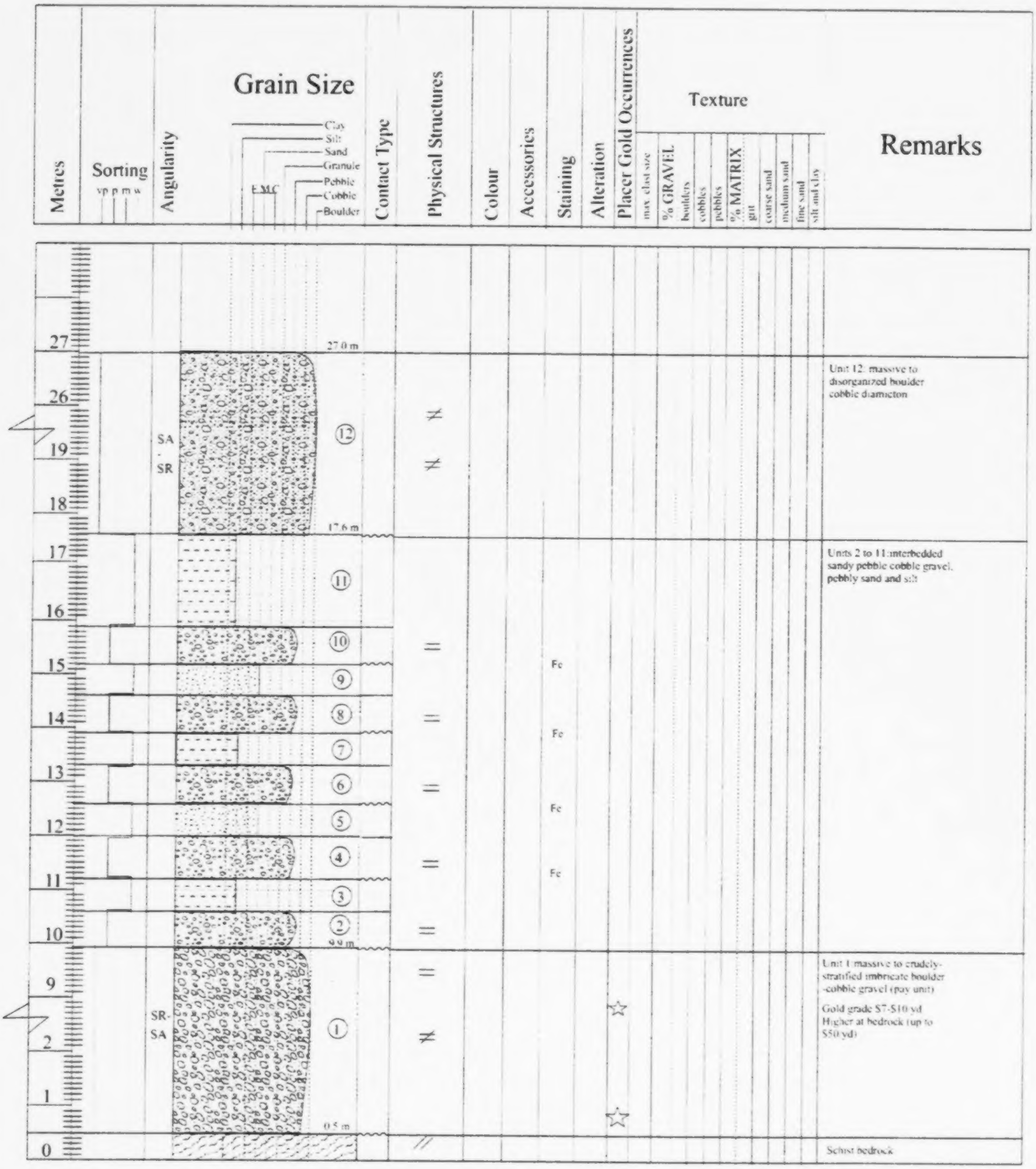
Unit 3: pebble gravel interbedded with pebbly coarse sand
Clasts fractured in top portion
-Matrix-supported
-Moderate imbrication (downstream)

Unit 2: gritty massive sand

Unit 1:
-Sandy matrix
-tightly packed

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 16/08/95 Section number: RB1-95 Measured by: WPL Creek or River: Ledge Creek NTS: 115P16
Latitude 63°40'37"N Longitude: 134°50'40"W Elevation: 2450 UTM: 0507696E,7060828N
Orientation: 225 ⟷ 135 upstream Geomorphic landform: Alluvial Fan-Delta



Unit 12: massive to disorganized boulder cobble diamicton

Units 2 to 11: interbedded sandy pebble cobble gravel, pebbly sand and silt

Unit 1: massive to crudely-stratified imbricate boulder-cobble gravel (pay unit)

Gold grade $7-$10 yd
Higher at bedrock (up to $50 yd)

Schist bedrock

Legend

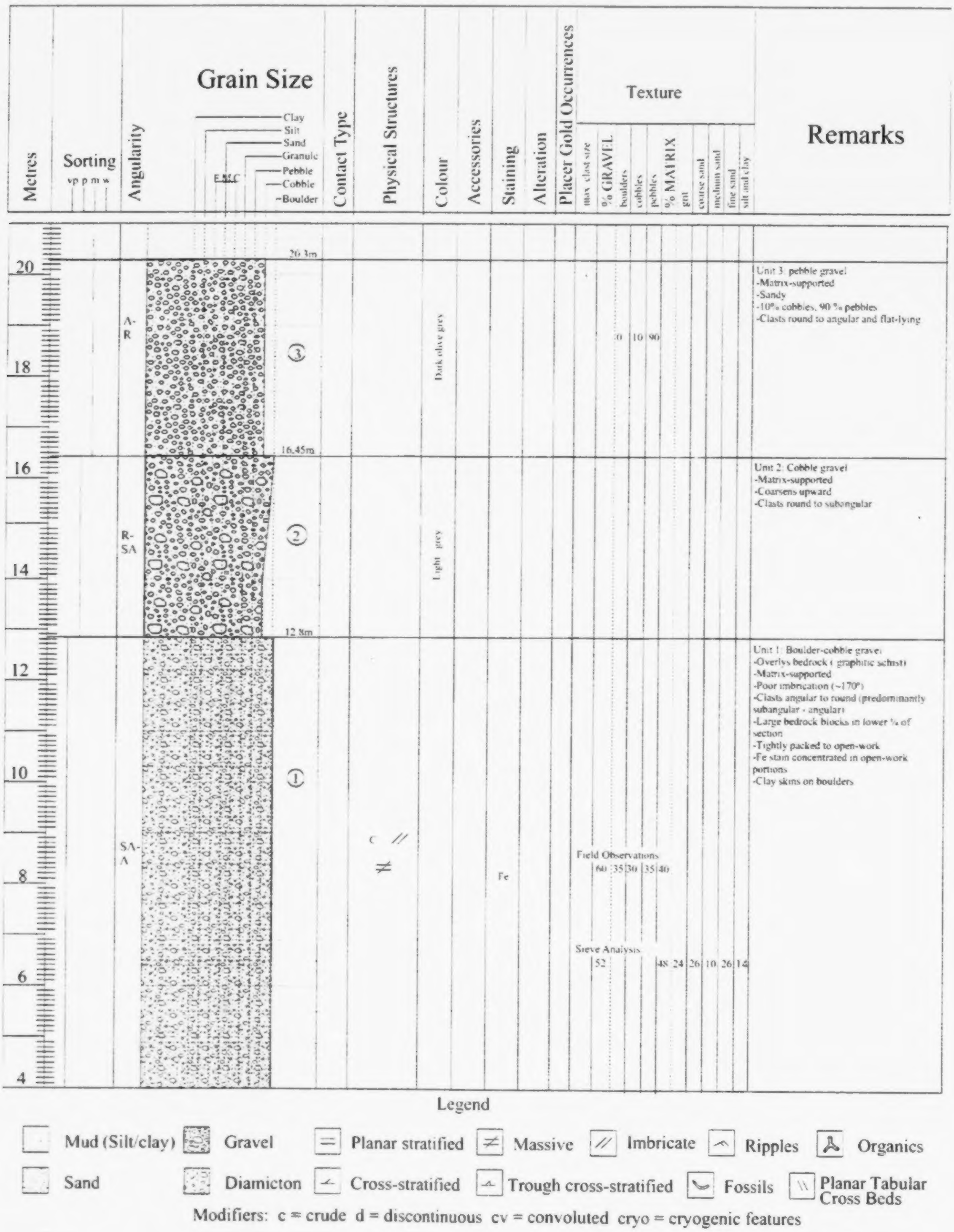
☐ Mud (Silt/clay)
▨ Gravel
= Planar stratified
≠ Massive
// Imbricate
Ripples
Organics
☐ Sand
Diamicton
Cross-stratified
Trough cross-stratified
Fossils
Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 04/08/97 Section number: LDG9701 Measured by: TA, LM, DM Creek or River: Ledge Creek NTS: 105M/10

Latitude: 63°40'54.0" Longitude: 134°50'20.4" Elevation: 2200 ft UTM: E507965, N7061358

Orientation: 010° ⟷ 190° Geomorphic landform: Alluvial fan delta

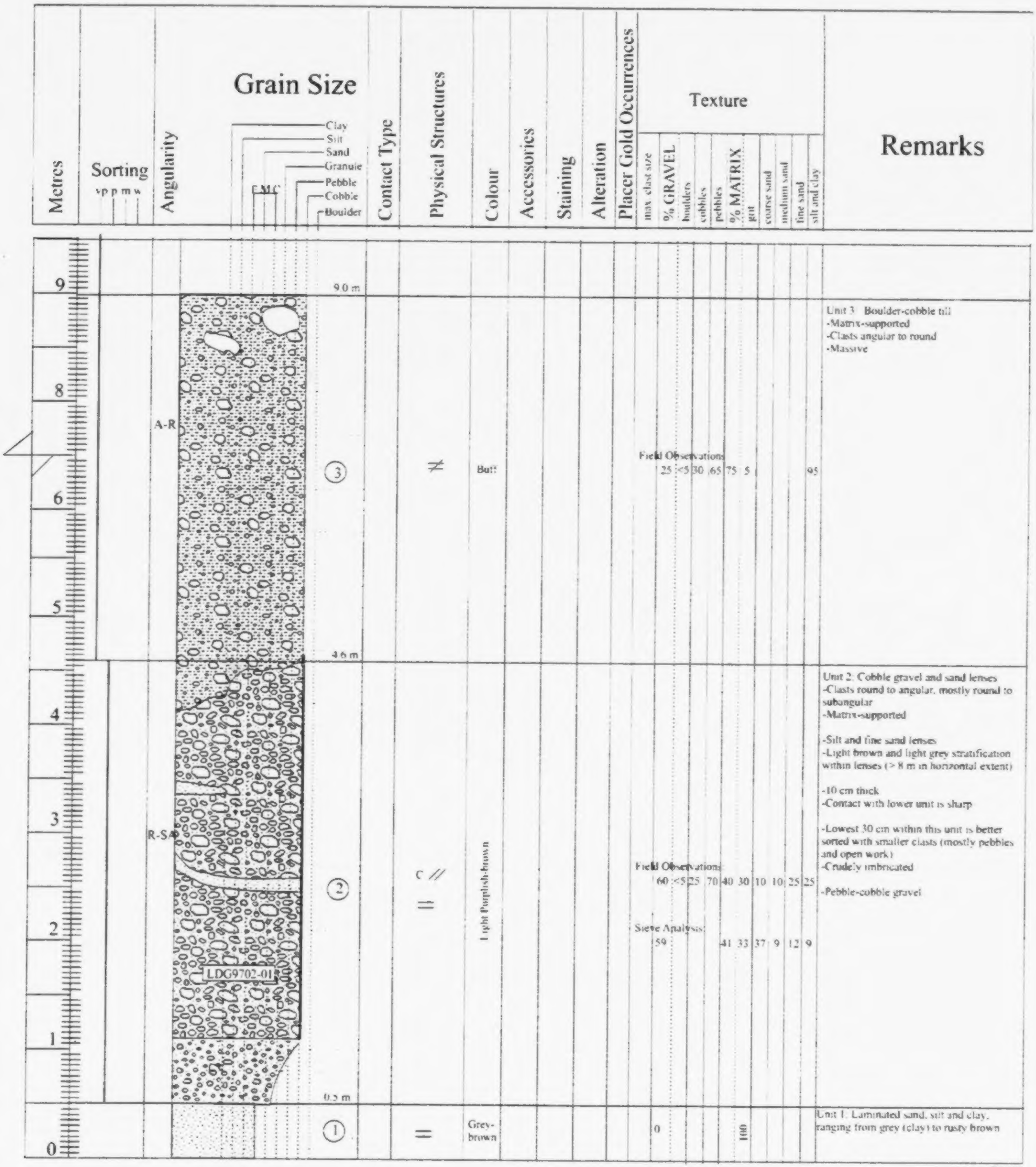


Unit 3: pebble gravel
-Matrix-supported
-Sandy
-10% cobbles, 90 % pebbles
-Clasts round to angular and flat-lying

Unit 2: Cobble gravel
-Matrix-supported
-Coarsens upward
-Clasts round to subangular

Unit 1: Boulder-cobble gravel
-Overlys bedrock (graphitic schist)
-Matrix-supported
-Poor imbrication (~170°)
-Clasts angular to round (predominantly subangular - angular)
-Large bedrock blocks in lower ¼ of section
-Tightly packed to open-work
-Fe stain concentrated in open-work portions
-Clay skins on boulders

Date: 04/08/97 Section number: LDG9702 Measured by: LM.DM Creek or River: Ledge Creek NTS: 105 M/10
Latitude: 63°40'37.9" Longitude: 134°50'29.8" Elevation: 2450 ft UTM: E507837, N7060858
Orientation: 215° ds ⟷ 035° us Geomorphic landform: Alluvial Fan-Delta



Field Observations
25 <5 30 65 75 5 95

Unit 3 Boulder-cobble till
-Matrix-supported
-Clasts angular to round
-Massive

Field Observations
60 <5 25 70 40 30 10 10 25 25

Sieve Analysis:
59 41 33 37 9 12 9

Unit 2: Cobble gravel and sand lenses
-Clasts round to angular, mostly round to subangular
-Matrix-supported

-Silt and fine sand lenses
-Light brown and light grey stratification within lenses (> 8 m in horizontal extent)

-10 cm thick
-Contact with lower unit is sharp

-Lowest 30 cm within this unit is better sorted with smaller clasts (mostly pebbles and open work)
-Crudely imbricated

-Pebble-cobble gravel

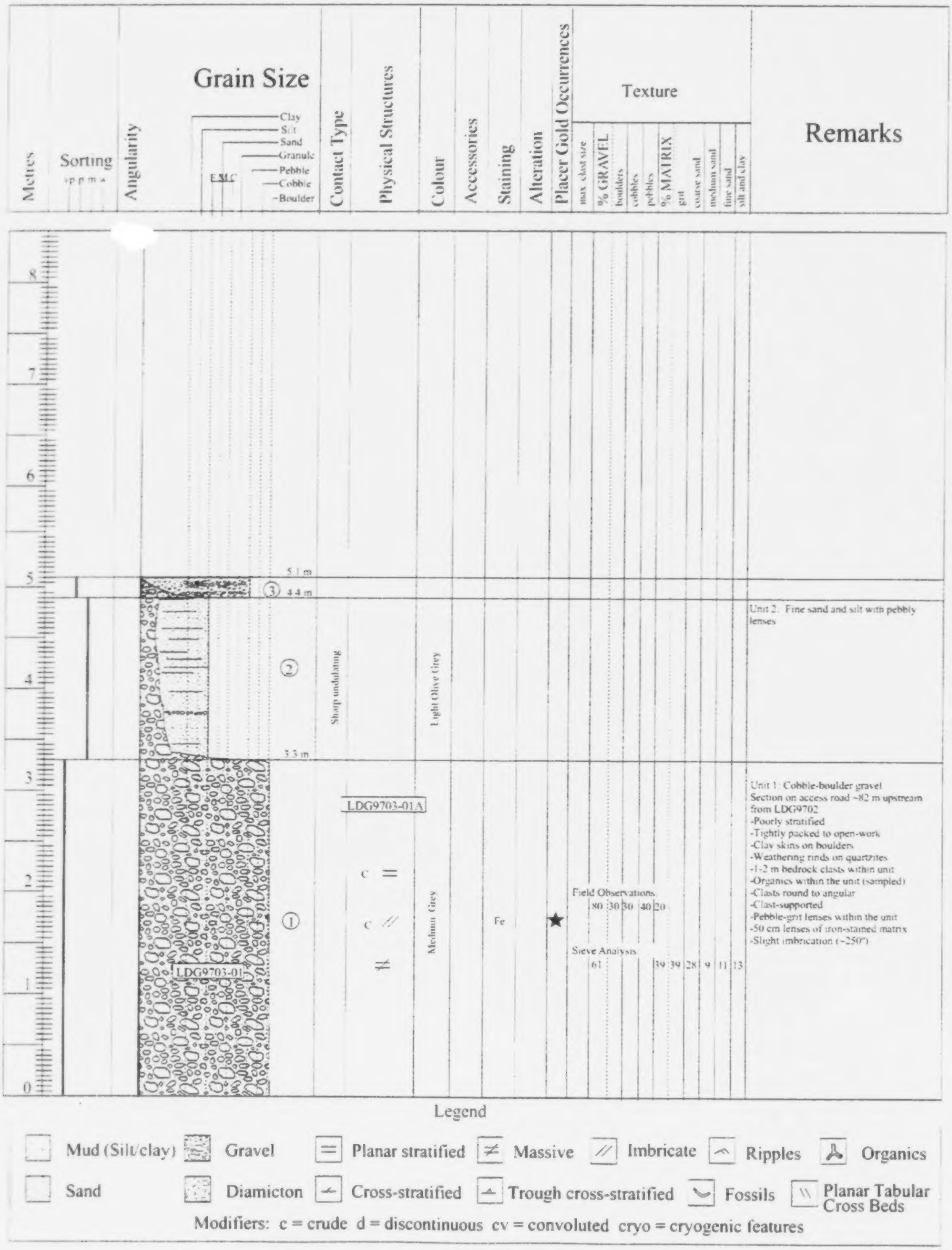
0 100

Unit 1. Laminated sand, silt and clay, ranging from grey (clay) to rusty brown

Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌃ Ripples ⅄ Organics
▨ Sand ▨ Diamicton ⌐ Cross-stratified ⌂ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds
Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

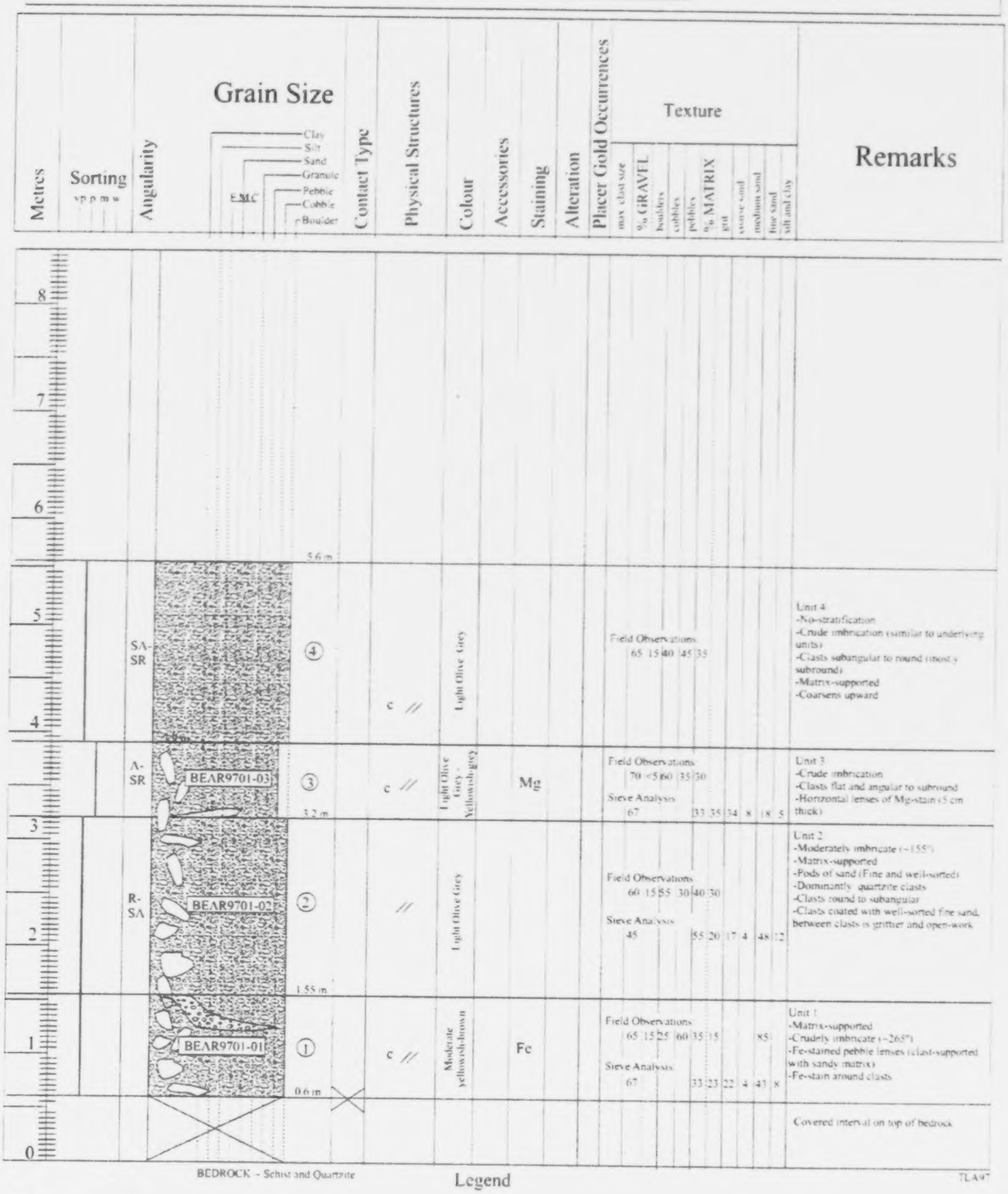
Date: 04/08/97 Section number: LDG9703 Measured by: TA Creek or River: Ledge Creek NTS: 105 M/10
Latitude: 63°40'37.9" Longitude: 134°50'29.8" Elevation: 2500 ft UTM: E507837, N7060858
Orientation: 215° ⟷ 035° Geomorphic landform: Alluvial Fan-Delta



Unit 2: Fine sand and silt with pebbly lenses

Unit 1: Cobble-boulder gravel
Section on access road ~82 m upstream from LDG9702
-Poorly stratified
-Tightly packed to open-work
-Clay skins on boulders
-Weathering rinds on quartzites
-1-2 m bedrock clasts within unit
-Organics within the unit (sampled)
-Clasts round to angular
-Clast-supported
-Pebble-grit lenses within the unit
-50 cm lenses of iron-stained matrix
-Slight imbrication (~250°)

Date: 07 / 08 / 97 Section number: BEAR9701 Measured by: TA, LM Creek or River: Bear Creek NTS: 115P/9
Latitude: 63°41'20" Longitude: 136°20'49" Elevation: 2400 ft UTM: E433390, N7062830
Orientation: 002° US ⟷ 182° DS Geomorphic landform:



Unit 4
-No-stratification
-Crude imbrication (similar to underlying units)
-Clasts subangular to round (mostly subround)
-Matrix-supported
-Coarsens upward

Unit 3
-Crude imbrication
-Clasts flat and angular to subround
-Horizontal lenses of Mg-stain (5 cm thick)

Unit 2
-Moderately imbricate (~155°)
-Matrix-supported
-Pods of sand (Fine and well-sorted)
-Dominantly quartzite clasts
-Clasts round to subangular
-Clasts coated with well-sorted fine sand, between clasts is grittier and open-work

Unit 1
-Matrix-supported
-Crudely imbricate (~265°)
-Fe-stained pebble lenses (clast-supported with sandy matrix)
-Fe-stain around clasts

Covered interval on top of bedrock

Legend

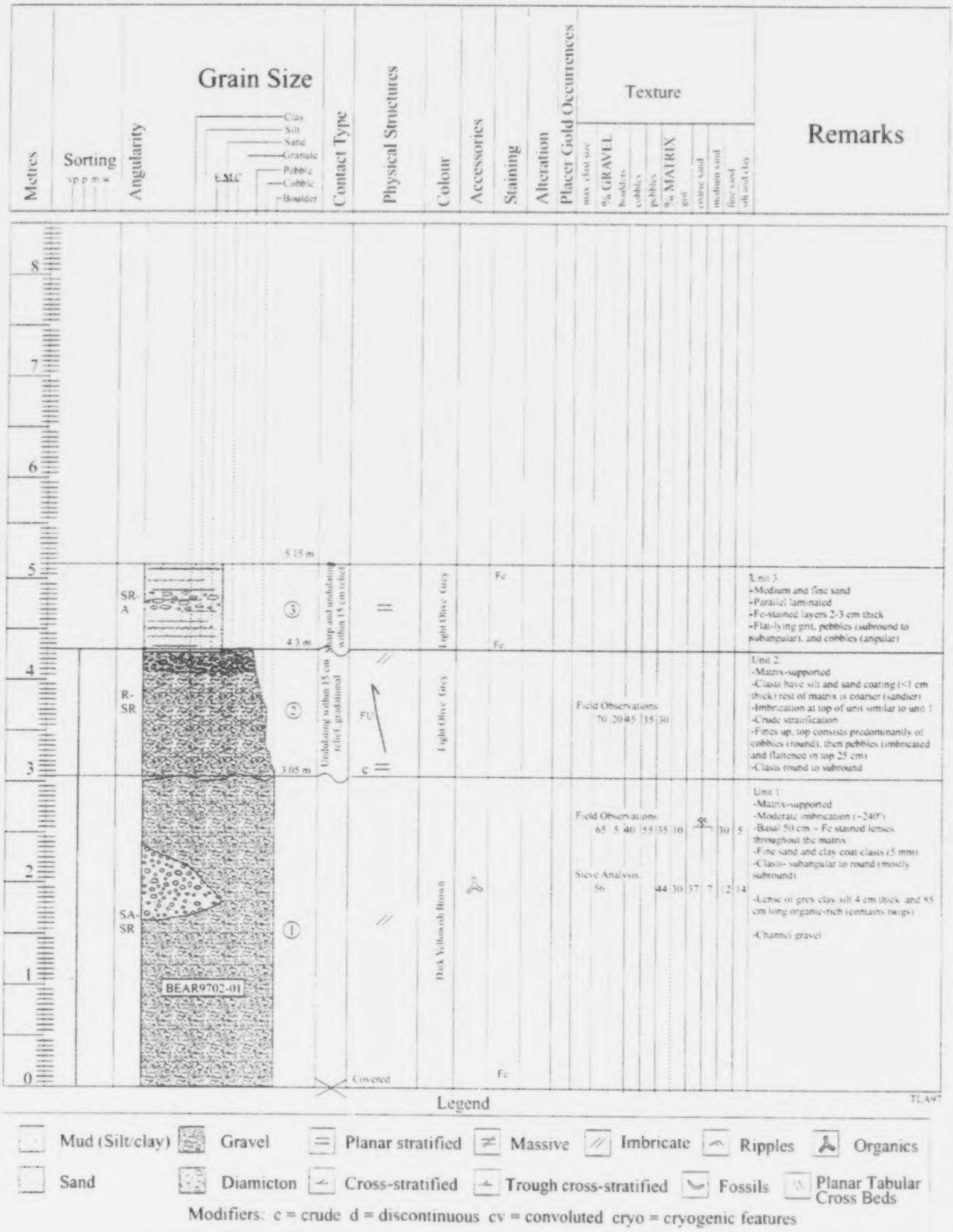
☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
▨ Sand	▨ Diamicton	⁄ Cross-stratified	⌃ Trough cross-stratified	◡ Fossils	⫽ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 07/08/97 Section number: BEAR9702 Measured by: TA, LM Creek or River: Bear Creek NTS: 115P/9

Latitude: 63°40'54" Longitude: 136°21'07" Elevation: 2450 ft UTM: E433104, N7062098

Orientation: 090° US ↔ 270° DS Geomorphic landform: ________



Unit 3
- Medium and fine sand
- Parallel laminated
- Fe-stained layers 2-3 cm thick
- Flat-lying grit, pebbles (subround to subangular), and cobbles (angular)

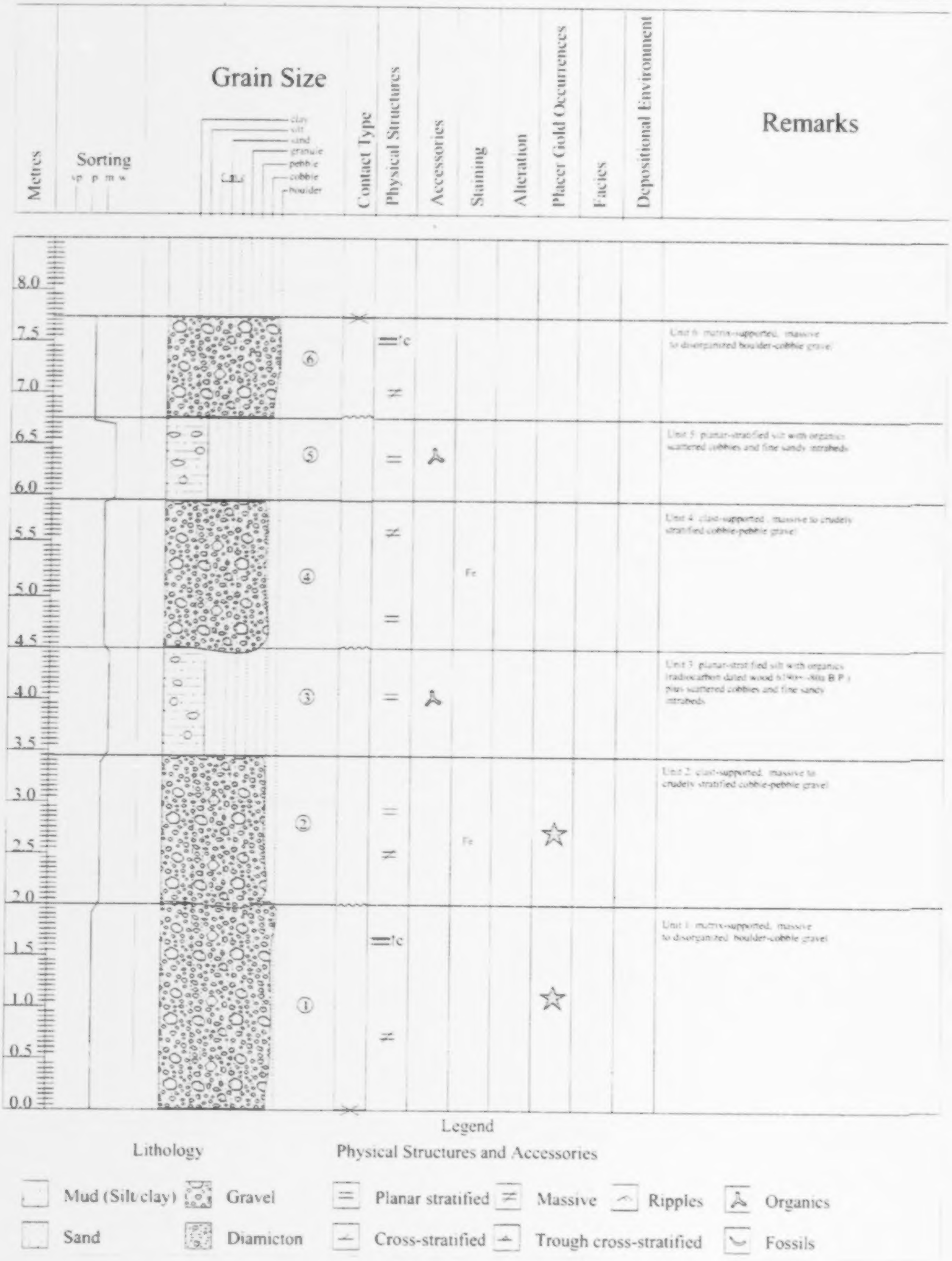
Unit 2
- Matrix-supported
- Clasts have silt and sand coating (<1 cm thick) rest of matrix is coarser (sandier)
- Imbrication at top of unit similar to unit 1
- Crude stratification
- Fines up, top consists predominantly of cobbles (round), then pebbles (imbricated and flattened in top 25 cm)
- Clasts round to subround

Unit 1
- Matrix-supported
- Moderate imbrication (~240°)
- Basal 50 cm – Fe stained lenses throughout the matrix
- Fine sand and clay coat clasts (5 mm)
- Clasts- subangular to round (mostly subround)

- Lense of grey clay silt 4 cm thick and 85 cm long organic-rich (contains twigs)

- Channel gravel

Date: 30/08/95 Section Number: FE1-95 Measured by: WPL Creek or River: Highet Creek NTS: 115P16
Latitude: 63°45'55"N Longitude: 136 12'49"W Elevation: 3450 ft Geomorphic Landform: Valley-fill
Orientation: 77 <-----------> 257 upstream



Unit 6: matrix-supported, massive to disorganized boulder-cobble gravel

Unit 5: planar-stratified silt with organics scattered cobbles and fine sandy intrabeds

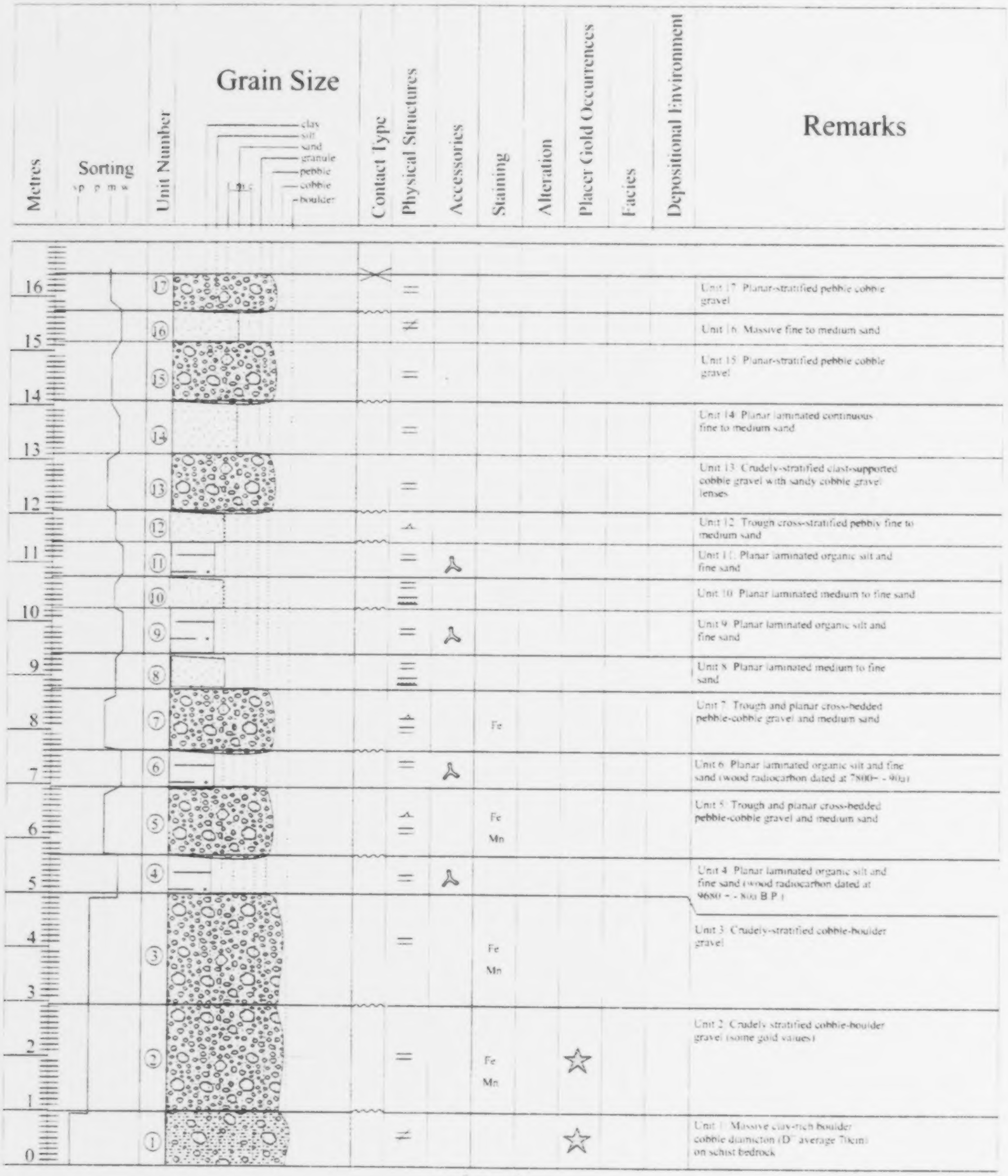
Unit 4: clast-supported, massive to crudely stratified cobble-pebble gravel

Unit 3: planar-stratified silt with organics (radiocarbon dated wood 6190+/-80 B.P.) plus scattered cobbles and fine sandy intrabeds

Unit 2: clast-supported, massive to crudely stratified cobble-pebble gravel

Unit 1: matrix-supported, massive to disorganized boulder-cobble gravel

Date: 22/09/95 Section Number: MP1-95 Measured by: WPL Creek or River: Highet Creek NTS: 115P09
Latitude: 63°44'16"N Longitude: 136°08'35"W UTM: 443570E, 7068299N Elevation: 2560 ft
Orientation: 80 <------------> 260 Right angles to stream Geomorphic Landform: Valley fill



Unit 17: Planar-stratified pebble cobble gravel

Unit 16: Massive fine to medium sand

Unit 15: Planar-stratified pebble cobble gravel

Unit 14: Planar laminated continuous fine to medium sand

Unit 13: Crudely-stratified clast-supported cobble gravel with sandy cobble gravel lenses

Unit 12: Trough cross-stratified pebbly fine to medium sand

Unit 11: Planar laminated organic silt and fine sand

Unit 10: Planar laminated medium to fine sand

Unit 9: Planar laminated organic silt and fine sand

Unit 8: Planar laminated medium to fine sand

Unit 7: Trough and planar cross-bedded pebble-cobble gravel and medium sand

Unit 6: Planar laminated organic silt and fine sand (wood radiocarbon dated at 7800 ± 90a)

Unit 5: Trough and planar cross-bedded pebble-cobble gravel and medium sand

Unit 4: Planar laminated organic silt and fine sand (wood radiocarbon dated at 9680 ± 80a B.P.)

Unit 3: Crudely-stratified cobble-boulder gravel

Unit 2: Crudely stratified cobble-boulder gravel (some gold values)

Unit 1: Massive clay-rich boulder cobble diamicton ($\bar{D}$ average 70cm) on schist bedrock

Legend

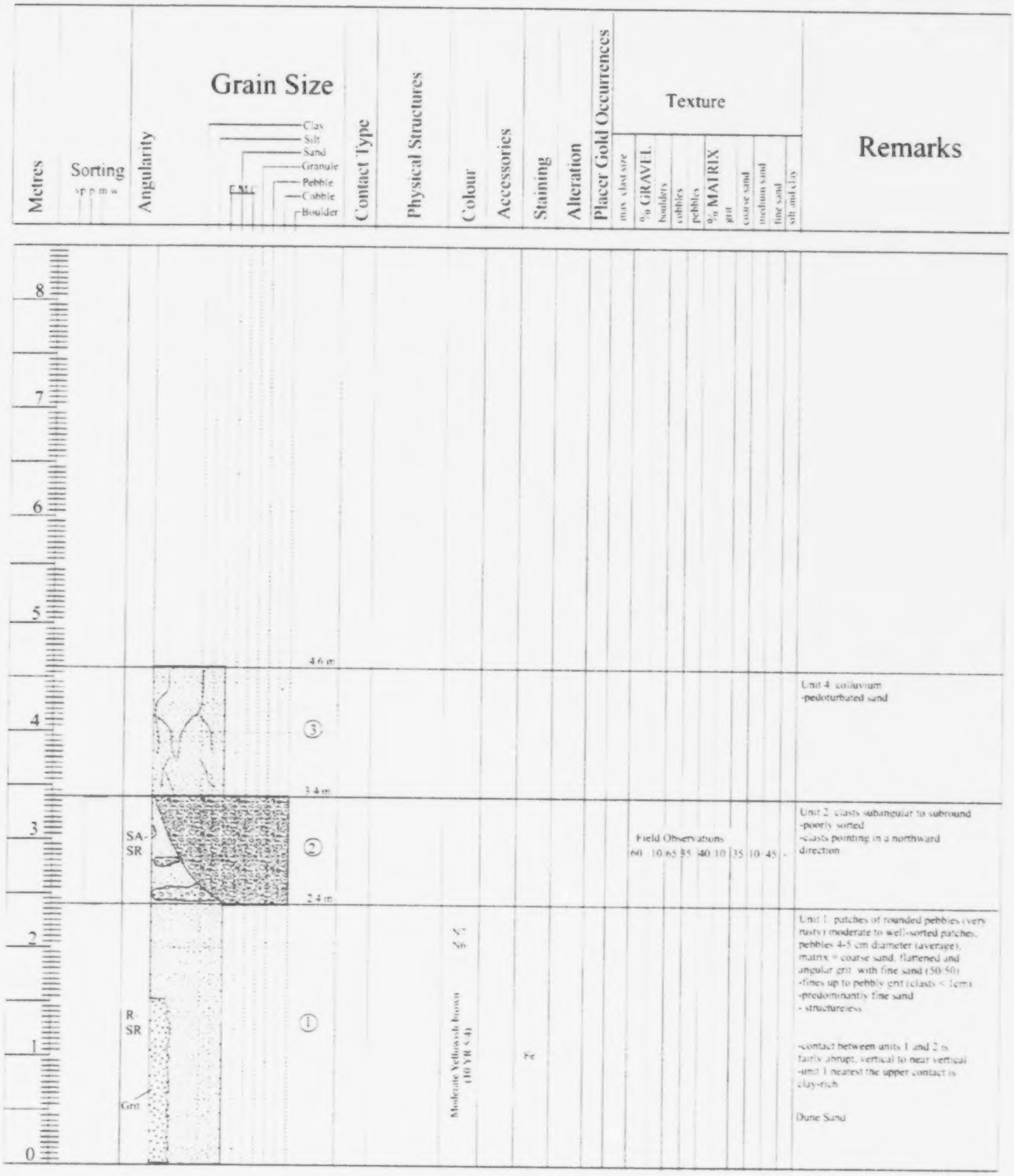
Lithology

☐ Mud (Silt/clay)
☐ Sand
▨ Gravel
▨ Diamicton

Physical Structures and Accessories

= Planar stratified
≠ Massive
⌒ Ripples
⅄ Organics
∠ Cross-stratified
⌒ Trough cross-stratified
◡ Fossils

Date: 09 06 97 Section number: HCR9701 Measured by: TA, DM Creek or River: Road to Highet Creek NTS: 105M 12
Latitude: 63°43'19.8" Longitude: 135°59'28.2" Elevation: 2070 ft UTM: 451039E, 7066242N
Orientation: 085° ⟷ 265° Geomorphic landform:



Field Observations
60 | 10 | 65 | 35 | 40 | 10 | 35 | 10 | 45 | -

Unit 4: colluvium
-pedoturbated sand

Unit 2: clasts subangular to subround
-poorly sorted
-clasts pointing in a northward direction

Unit 1: patches of rounded pebbles (very rusty) moderate to well-sorted patches, pebbles 4-5 cm diameter (average), matrix = coarse sand, flattened and angular grit with fine sand (50/50)
-fines up to pebbly grit (clasts < 1cm)
-predominantly fine sand
- structureless

-contact between units 1 and 2 is fairly abrupt, vertical to near vertical
-unit 1 nearest the upper contact is clay-rich

Dune Sand

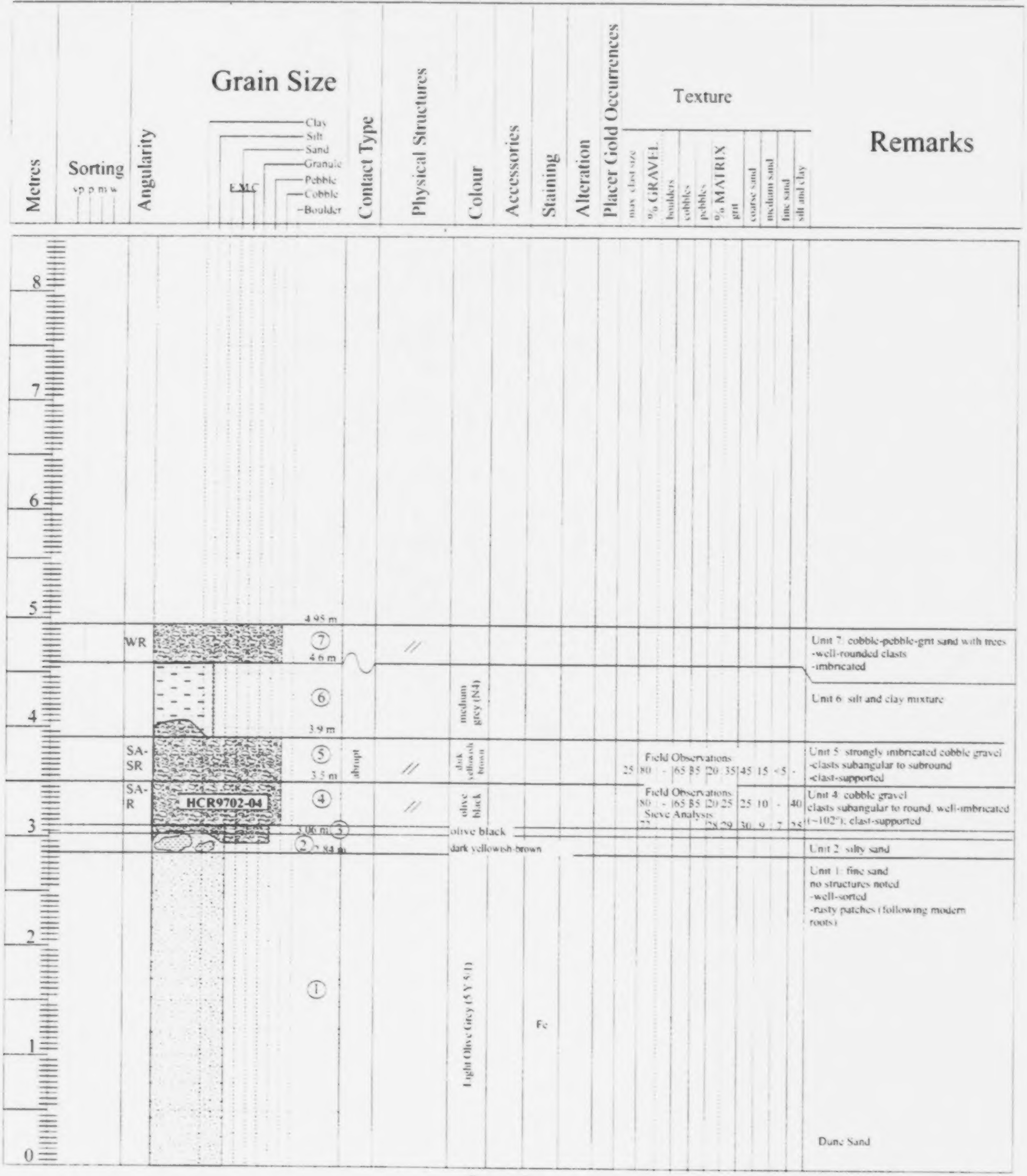
Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics
☐ Sand ▨ Diamicton ∠ Cross-stratified ⌒ Trough cross-stratified ◡ Fossils ⫽ Planar Tabular Cross Beds
Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 09 06 97 Section number: HCR9702 Measured by: TA, DM Creek or River: Road to Highet Creek next to Roaring Fork Creek NTS: 115P/9

Latitude: ________ Longitude: ________ Elevation: 2100 ft UTM: ________

Orientation: 305° ⟷ 125° Geomorphic landform: ________



Legend

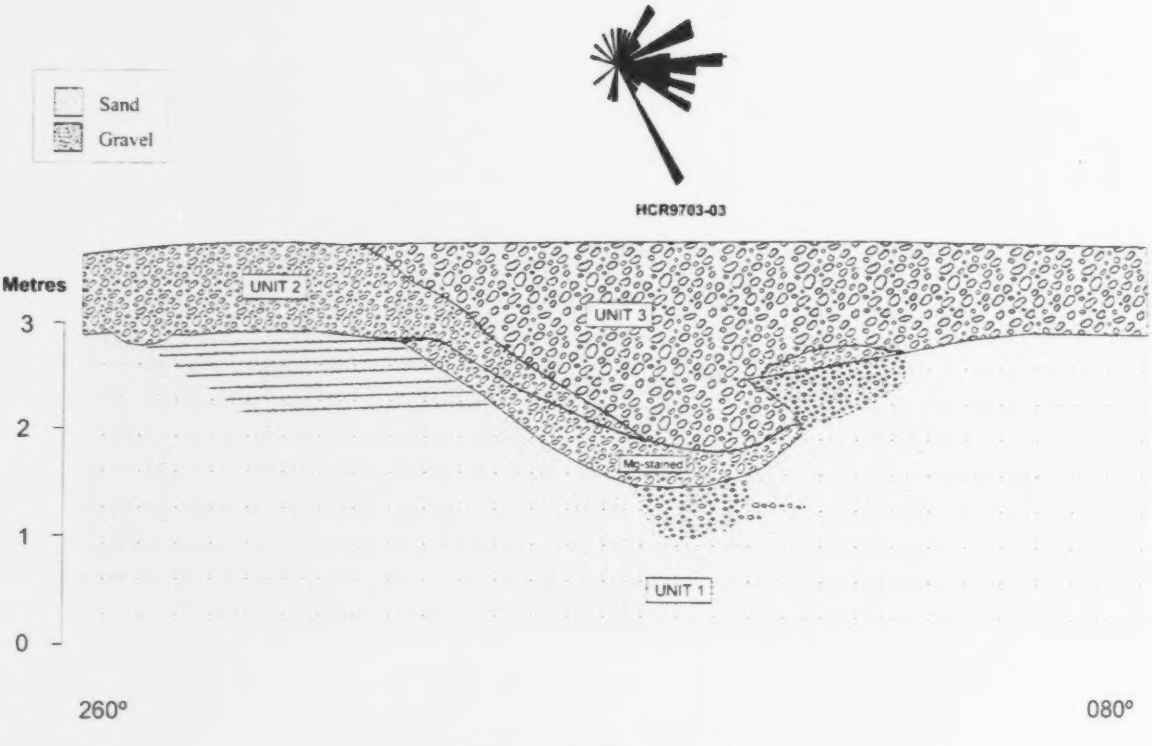
☐ Mud (Silt/clay) ▨ Gravel ☰ Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics

☐ Sand ▨ Diamicton ⊥ Cross-stratified △ Trough cross-stratified ◡ Fossils

Date: 09/07/97 Section number: HCR9703-03 Measured by: TA, DM Creek or River: Highet Creek Road NTS: 115P/9

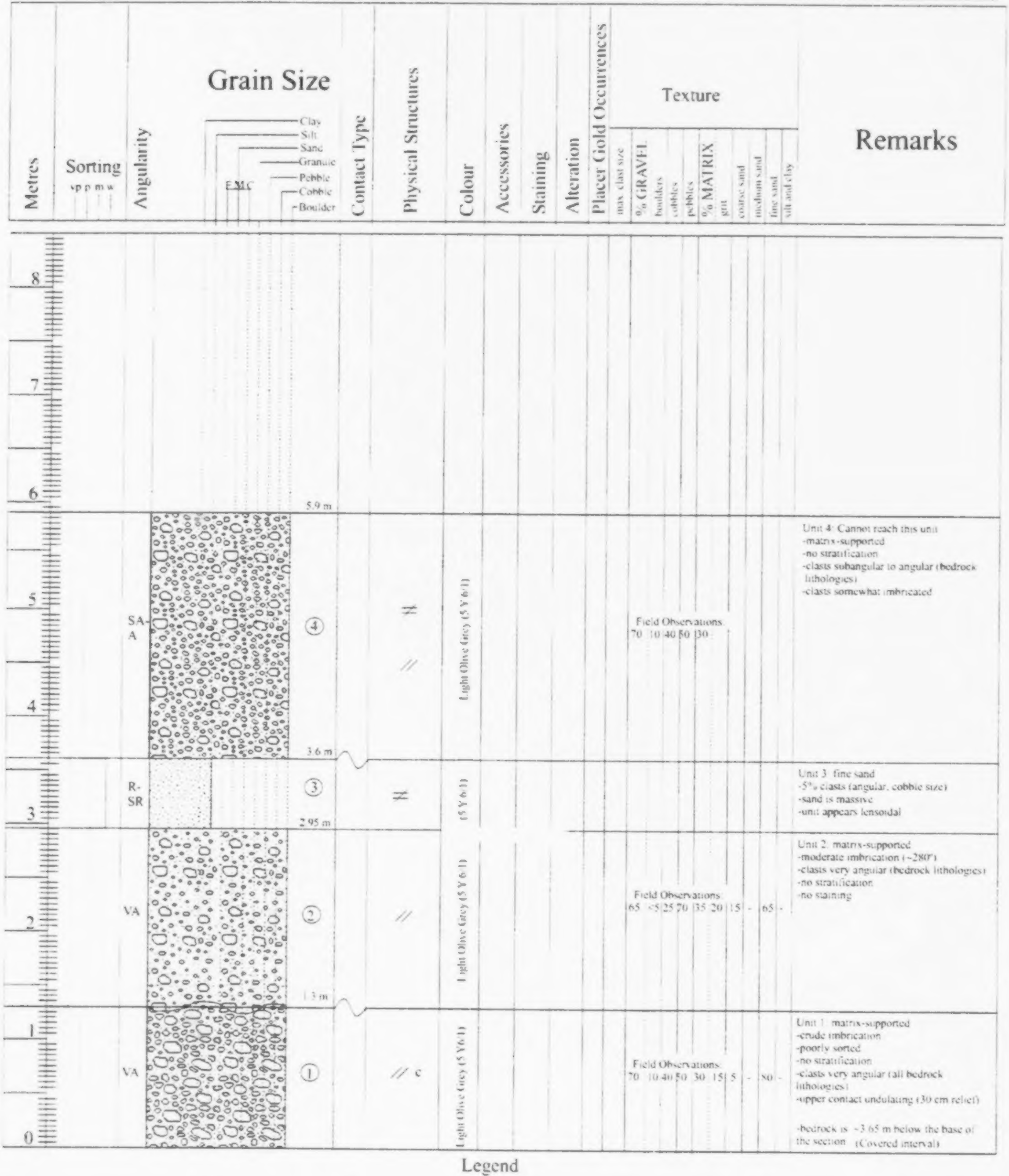
Latitude: 63°43'26.7" Longitude: 136°03'2.3" Elevation: 2180 ft Utm: 448105E, 7066502N

Orientation: 260° ⟷ 080° Geomorphic landform: ______



HCR9703, Hight Creek Road

Date: 06/08/97 Section number: HCR9704 Measured by: TA, LM Creek or River: Highet Creek NTS: 115P/16
Latitude: ________ Longitude: ________ Elevation: 3290 ft UTM: 441006E, 7071619N next to Rudolph Gulch
Orientation: 292° us ⟷ 112° ds Geomorphic landform: ________



Unit 4: Cannot reach this unit
-matrix-supported
-no stratification
-clasts subangular to angular (bedrock lithologies)
-clasts somewhat imbricated

Unit 3: fine sand
-5% clasts (angular, cobble size)
-sand is massive
-unit appears lensoidal

Unit 2: matrix-supported
-moderate imbrication (~280°)
-clasts very angular (bedrock lithologies)
-no stratification
-no staining

Unit 1: matrix-supported
-crude imbrication
-poorly sorted
-no stratification
-clasts very angular (all bedrock lithologies)
-upper contact undulating (30 cm relief)

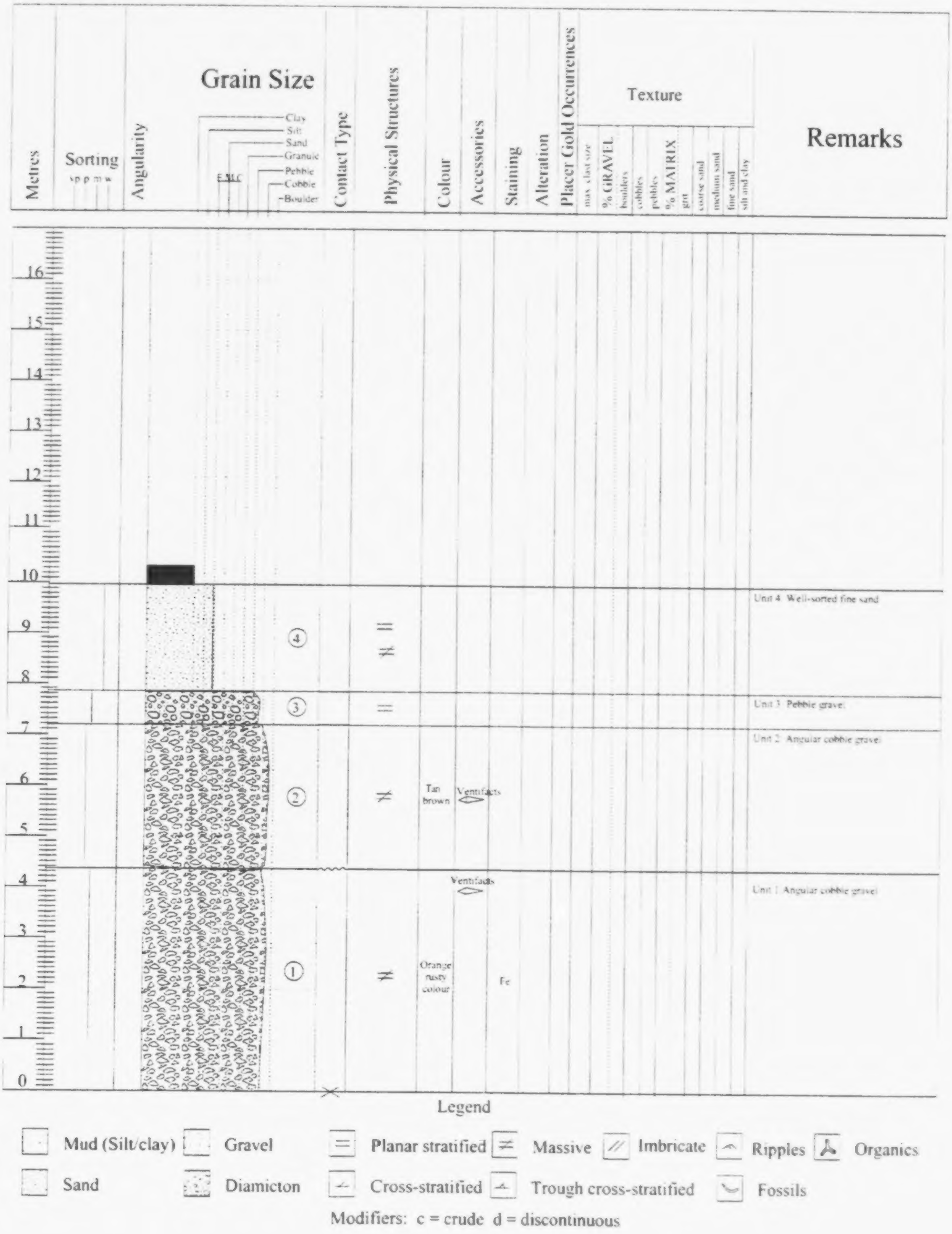
-bedrock is ~3.65 m below the base of the section (Covered interval)

Legend

☐ Mud (Silt/clay) ▨ Gravel ☰ Planar stratified ≠ Massive // Imbricate ⌒ Ripples Organics
☐ Sand ▨ Diamicton Cross-stratified Trough cross-stratified Fossils Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

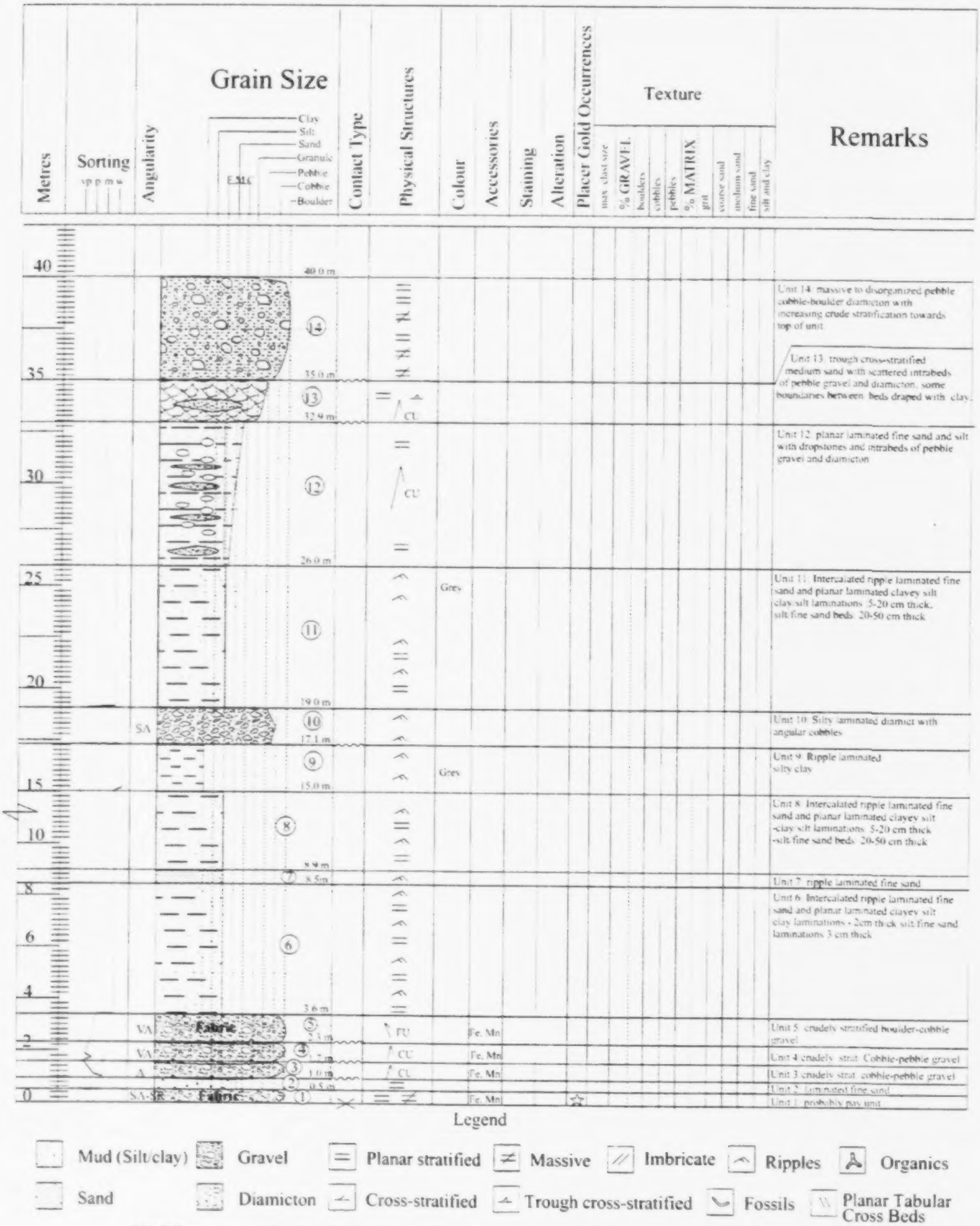
Date: 30/08/95 Section number: HT1-95 Measured by: WPL Creek or River: Highet Creek NTS: 115P16
Latitude 63°45'51"N Longitude: 136°10'43"W Elevation: 2980 UTM:
Orientation: 300 ⟷ 120 Downstream Geomorphic landform: Alluvial fan



Date: 16/09/95 Section number: HT2/3-95 Measured by: WPL Creek or River: Highet Creek NTS: 115P16

Latitude: 63°43'56"N Longitude: 136°07'49"W Elevation: 2500 ft. UTM: 04444187E, 7067472N

Orientation: 90 ⟷ 270 upstream Geomorphic landform: Glaciofluvial Terrace



Unit 14: massive to disorganized pebble cobble-boulder diamicton with increasing crude stratification towards top of unit

Unit 13: trough cross-stratified medium sand with scattered intrabeds of pebble gravel and diamicton, some boundaries between beds draped with clay.

Unit 12: planar laminated fine sand and silt with dropstones and intrabeds of pebble gravel and diamicton

Unit 11: Intercalated ripple laminated fine sand and planar laminated clayey silt clay/silt laminations 5-20 cm thick, silt/fine sand beds 20-50 cm thick

Unit 10: Silty laminated diamict with angular cobbles

Unit 9: Ripple laminated silty clay

Unit 8: Intercalated ripple laminated fine sand and planar laminated clayey silt -clay/silt laminations 5-20 cm thick -silt/fine sand beds 20-50 cm thick

Unit 7: ripple laminated fine sand

Unit 6: Intercalated ripple laminated fine sand and planar laminated clayey silt clay laminations - 2cm thick silt/fine sand laminations 3 cm thick

Unit 5: crudely stratified boulder-cobble gravel

Unit 4 crudely strat. Cobble-pebble gravel

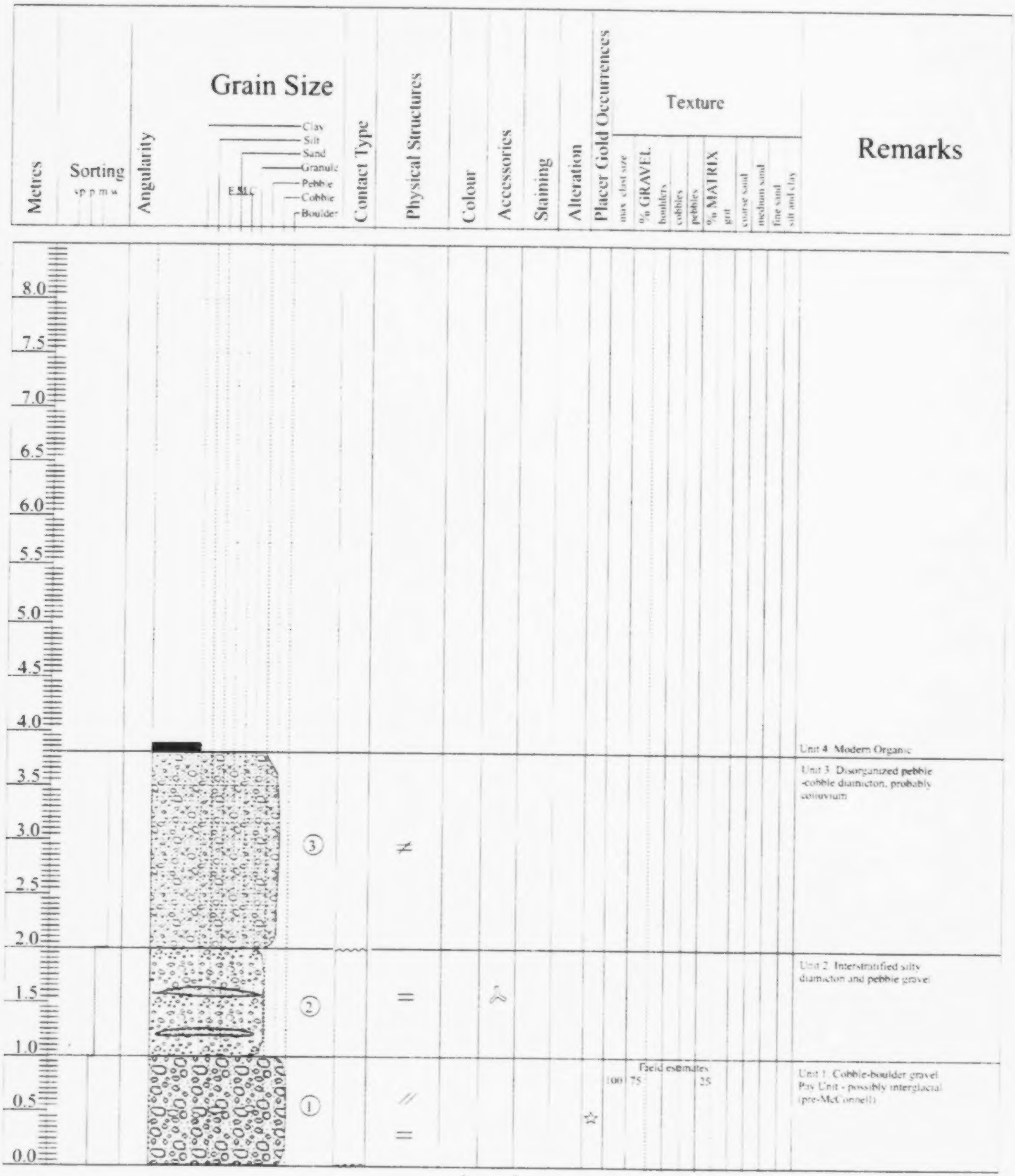
Unit 3 crudely strat. cobble-pebble gravel

Unit 2: laminated fine sand

Unit 1: probably pay unit

Modifiers: c = crude d = discontinuous f = fine cv = convoluted cryo = cryogenic features

Date: 29 08 95 Section number: KK1-95 Measured by: WPL Creek or River: Highet Creek NTS: 115P16
Latitude: 63 45'55"N Longitude: 136°11'31"W Elevation: 3125 ft UTM 0435987E.7128833N
Orientation: 290 ⟷ 110 Downstream Geomorphic landform: Alluvial Terrace



Unit 4 Modern Organic

Unit 3 Disorganized pebble -cobble diamicton, probably colluvium

Unit 2 Interstratified silty diamicton and pebble gravel

Unit 1 Cobble-boulder gravel Pay Unit - possibly interglacial (pre-McConnell)

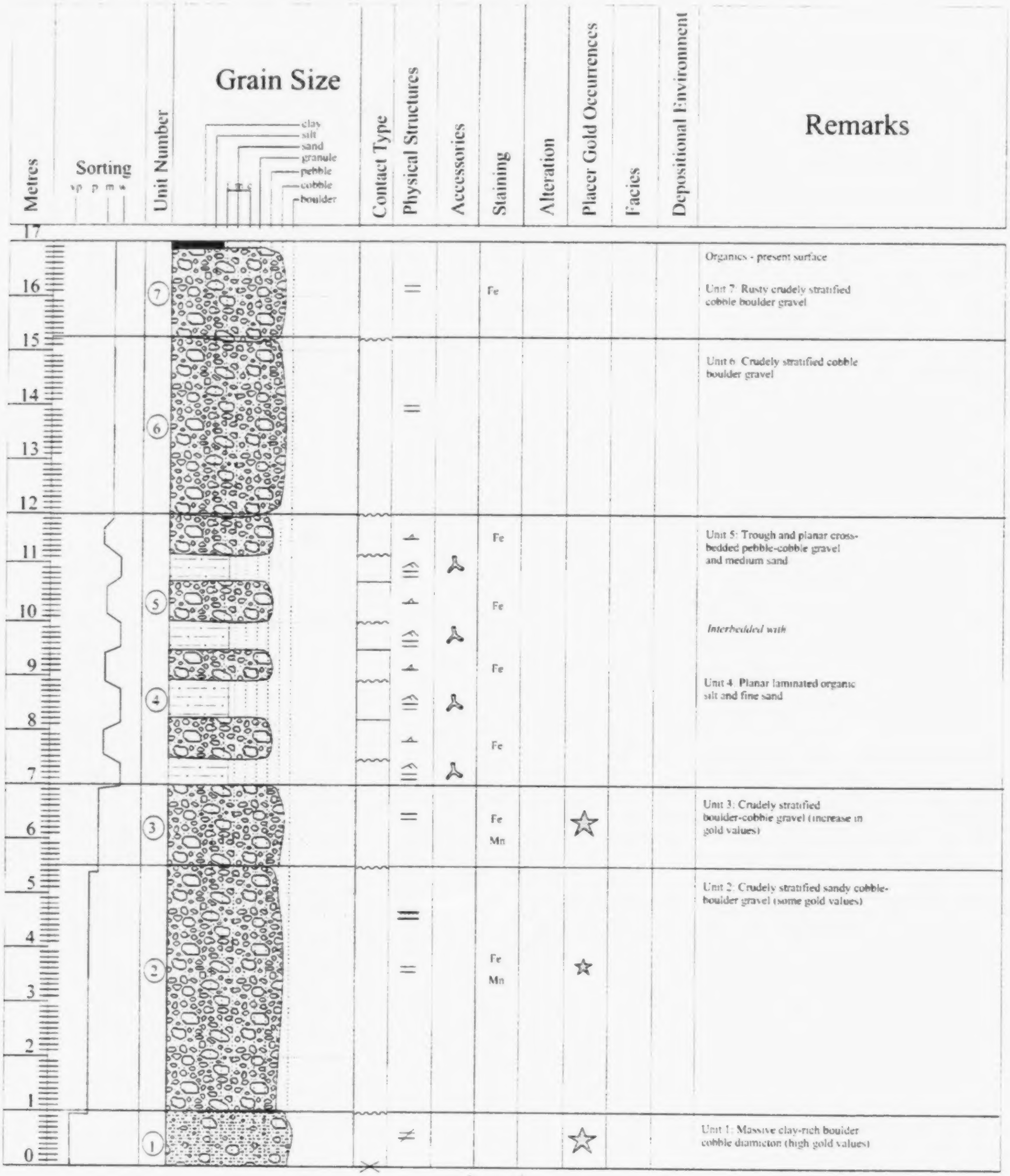
Legend

Mud (Silt/clay) Gravel = Planar stratified ≠ Massive // Imbricate Ripples Organics

Sand Diamicton Cross-stratified Trough cross-stratified Fossils

Modifiers: c = crude d = discontinuous

Date: 23/07/96 Section Number: WL9602 Measured by: LM/WL Creek or River: Highet Creek NTS: 115P09
Latitude: 63°44'24"N Longitude: 136°08'30"W Elevation: 2565 Geomorphic Landform: Valley fill
Orientation: 344 <------------> 164 downstream



Organics - present surface

Unit 7: Rusty crudely stratified cobble boulder gravel

Unit 6: Crudely stratified cobble boulder gravel

Unit 5: Trough and planar cross-bedded pebble-cobble gravel and medium sand

Interbedded with

Unit 4: Planar laminated organic silt and fine sand

Unit 3: Crudely stratified boulder-cobble gravel (increase in gold values)

Unit 2: Crudely stratified sandy cobble-boulder gravel (some gold values)

Unit 1: Massive clay-rich boulder cobble diamicton (high gold values)

Legend

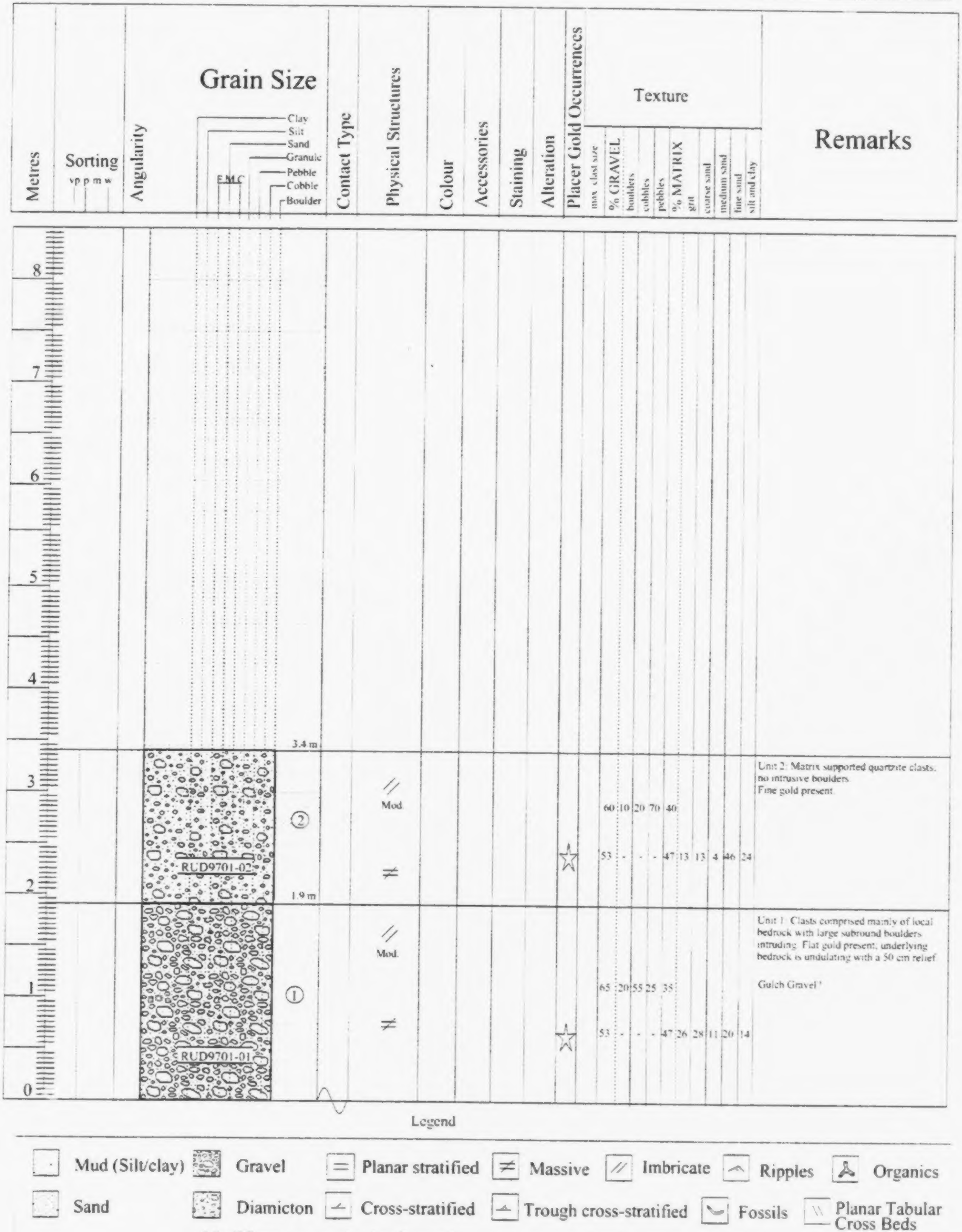
Lithology

Physical Structures and Accessories

☐	Mud (Silt/clay)	▨	Gravel	=	Planar stratified	≠	Massive
⛆	Sand	▨	Diamicton	∠	Cross-stratified	∠	Trough cross-stratified

⌒	Ripples
⅄	Organics
◡	Fossils

Date: 06 08 97 Section number: RUD9701 Measured by: TA, LM Creek or River: Rudolph Gulch NTS: 115P/16
Latitude: ____ Longitude: ____ Elevation: 3350 ft UTM: 440984E, 7071664N
Orientation: 225° us ⟷ 045° ds Geomorphic landform: Gulch gravels

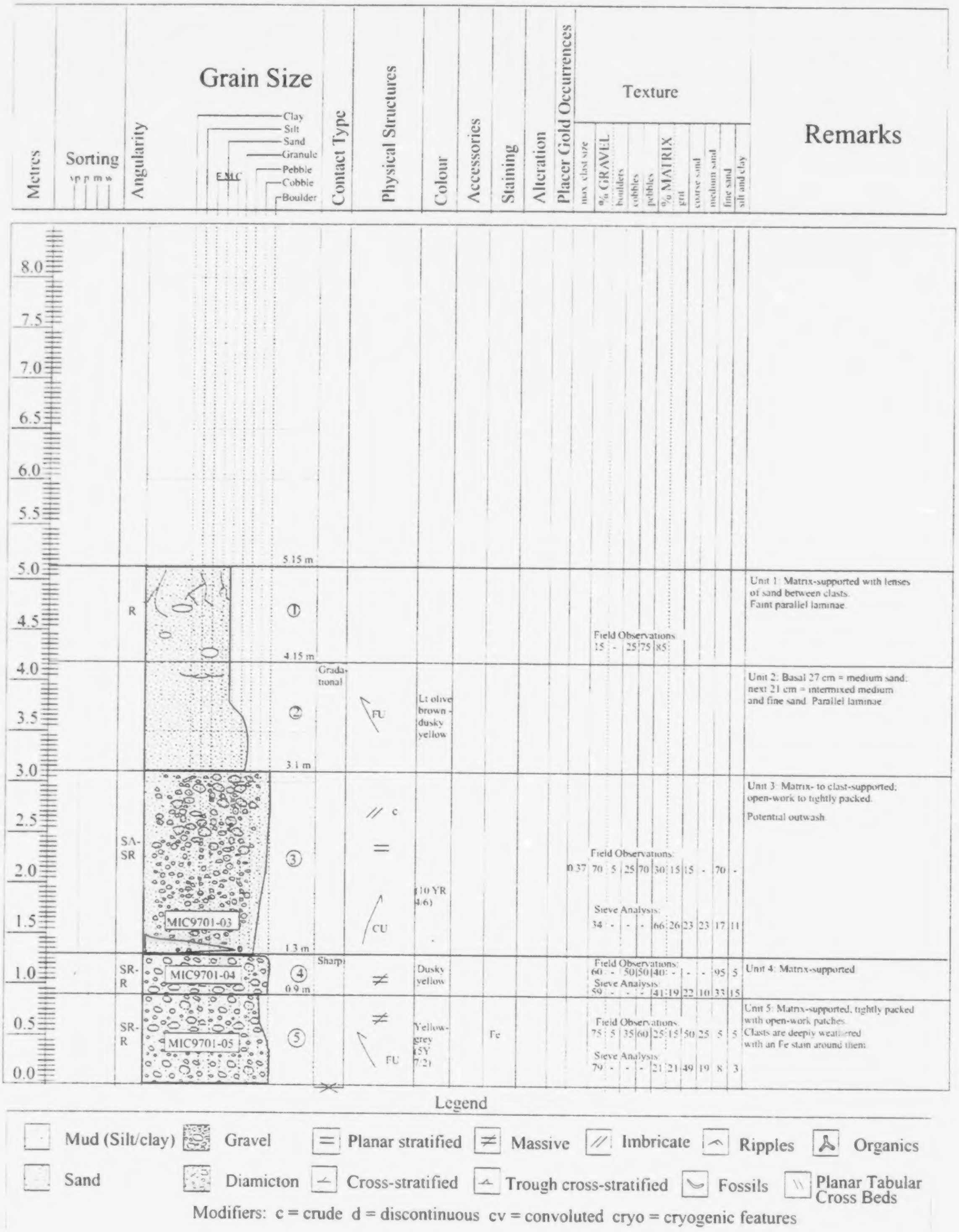


Unit 2: Matrix supported quartzite clasts, no intrusive boulders.
Fine gold present.

Unit 1: Clasts comprised mainly of local bedrock with large subround boulders intruding. Flat gold present; underlying bedrock is undulating with a 50 cm relief.

Gulch Gravel?

Date: 10/07/97 Section number: MIC9701 Measured by: TA, DM Creek or River: McIntyre Creek NTS: 115P/9
Latitude: ________ Longitude: ________ UTM: N7065999, E0444269 Elevation: 2500 ft (762 m)
Orientation: 100° ⟷ 280° Geomorphic landform: ________



Unit 1: Matrix-supported with lenses of sand between clasts. Faint parallel laminae.

Field Observations:
15 - 25 75 85

Unit 2: Basal 27 cm = medium sand; next 21 cm = intermixed medium and fine sand. Parallel laminae.

Unit 3: Matrix- to clast-supported; open-work to tightly packed.

Potential outwash.

Field Observations:
0.37 70 5 25 70 30 15 15 - 70 -

Sieve Analysis:
34 - - - 66 26 23 23 17 11

Unit 4: Matrix-supported

Field Observations:
60 - 50 50 40 - - - 95 5

Sieve Analysis:
59 - - - 41 19 22 10 33 15

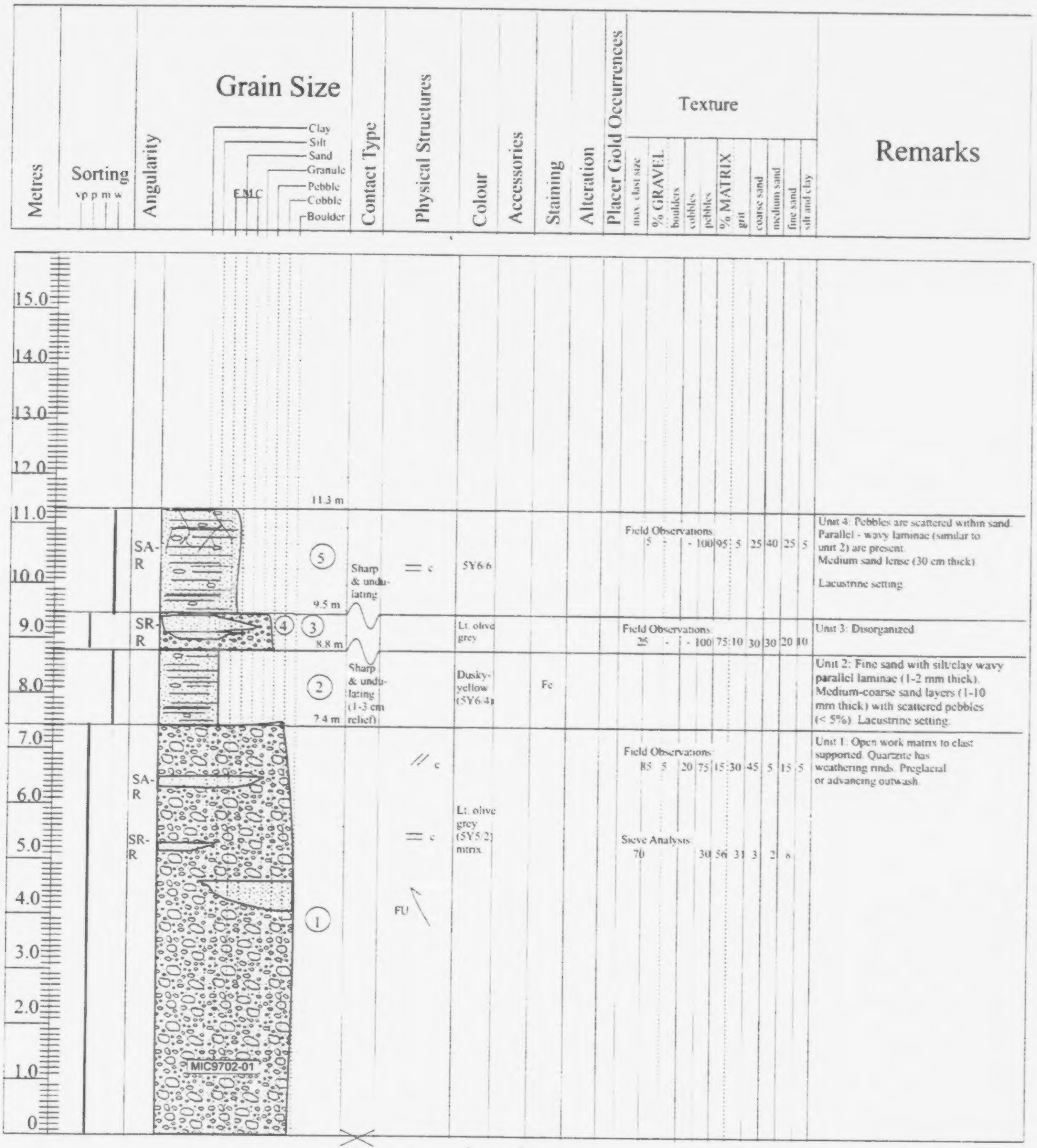
Unit 5: Matrix-supported, tightly packed with open-work patches. Clasts are deeply weathered with an Fe stain around them.

Field Observations:
75 5 35 60 25 15 50 25 5 5

Sieve Analysis:
79 - - - 21 21 49 19 8 3

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 10/07/97 Section number: MIC9702 Measured by: TA, DM Creek or River: McIntyre Creek NTS 115 P/9
Latitude: ________ Longitude: ________ Elevation: 2450 ft UTM: N7066056, E0444634
Orientation: 90° ⟷ 270° Geomorphic landform: Glacial-fluvial terrace



Field Observations:
5 - | - 100 | 95 | 5 | 25 | 40 | 25 | 5

Unit 4: Pebbles are scattered within sand. Parallel - wavy laminae (similar to unit 2) are present.
Medium sand lense (30 cm thick)

Lacustrine setting

Field Observations:
25 - | - 100 | 75 | 10 | 30 | 30 | 20 | 10

Unit 3: Disorganized

Unit 2: Fine sand with silt/clay wavy parallel laminae (1-2 mm thick). Medium-coarse sand layers (1-10 mm thick) with scattered pebbles (< 5%). Lacustrine setting.

Field Observations:
85 5 | 20 | 75 | 15 | 30 | 45 | 5 | 15 | 5

Sieve Analysis:
70 | 30 | 56 | 31 | 3 | 2 | 8

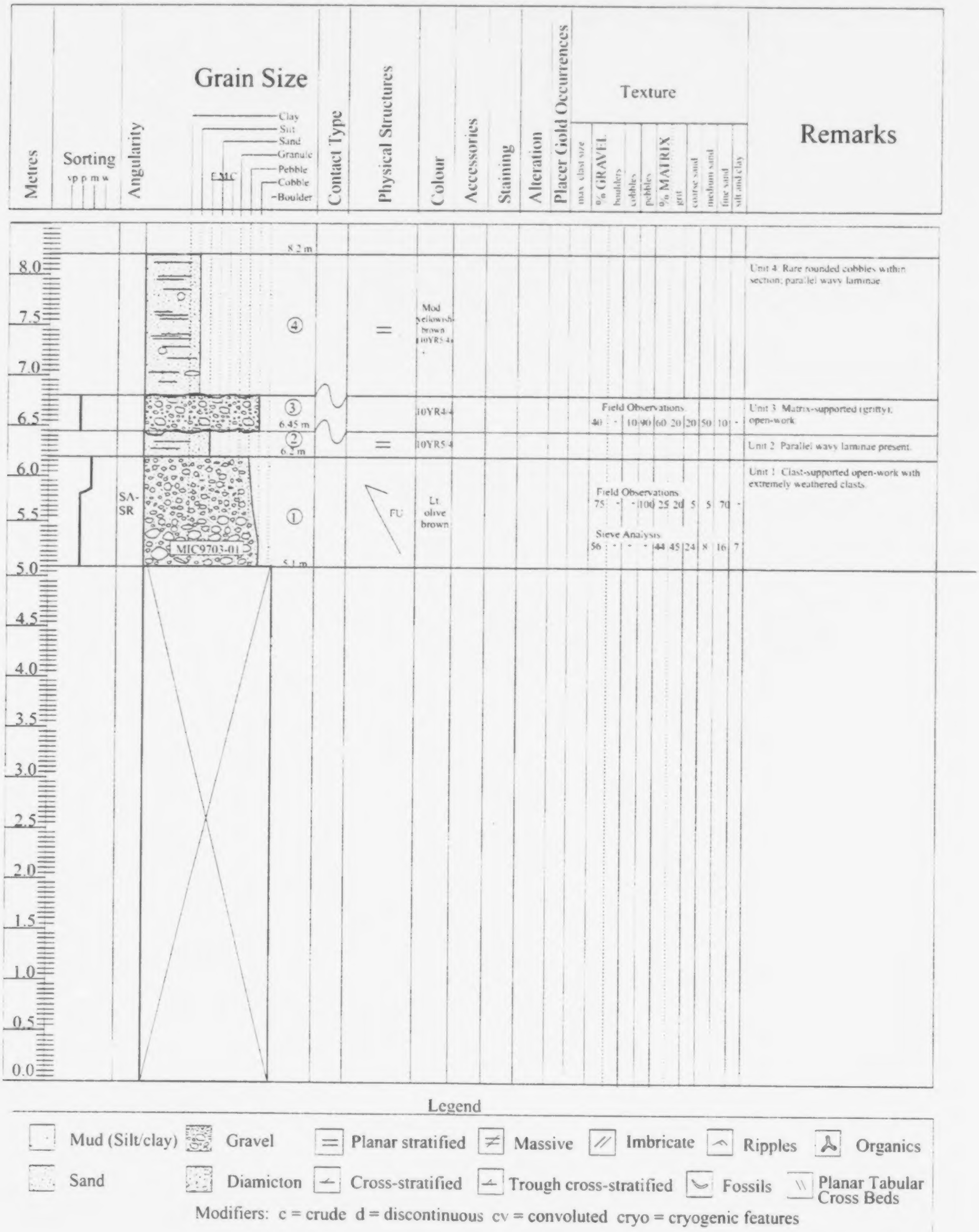
Unit 1: Open work matrix to clast supported. Quartzite has weathering rinds. Preglacial or advancing outwash.

Legend

☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
░ Sand	▨ Diamicton	⊥ Cross-stratified	⊥ Trough cross-stratified	◡ Fossils	\\ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 11/07/97 Section number: MIC9703 Measured by: TA, DM Creek or River: McIntyre Creek NTS: 115 P/9
Latitude: ________ Longitude: ________ Elevation: 790? m UTM: N7066082, E0444522
Orientation: 305 ←——→ 125 Geomorphic landform: Glacial-fluvial terrace



Unit 4: Rare rounded cobbles within section; parallel wavy laminae.

Unit 3: Matrix-supported (gritty), open-work.

Field Observations

max. clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay
40	-		10	90	60	20	20	50	10	-

Unit 2: Parallel wavy laminae present.

Unit 1: Clast-supported open-work with extremely weathered clasts.

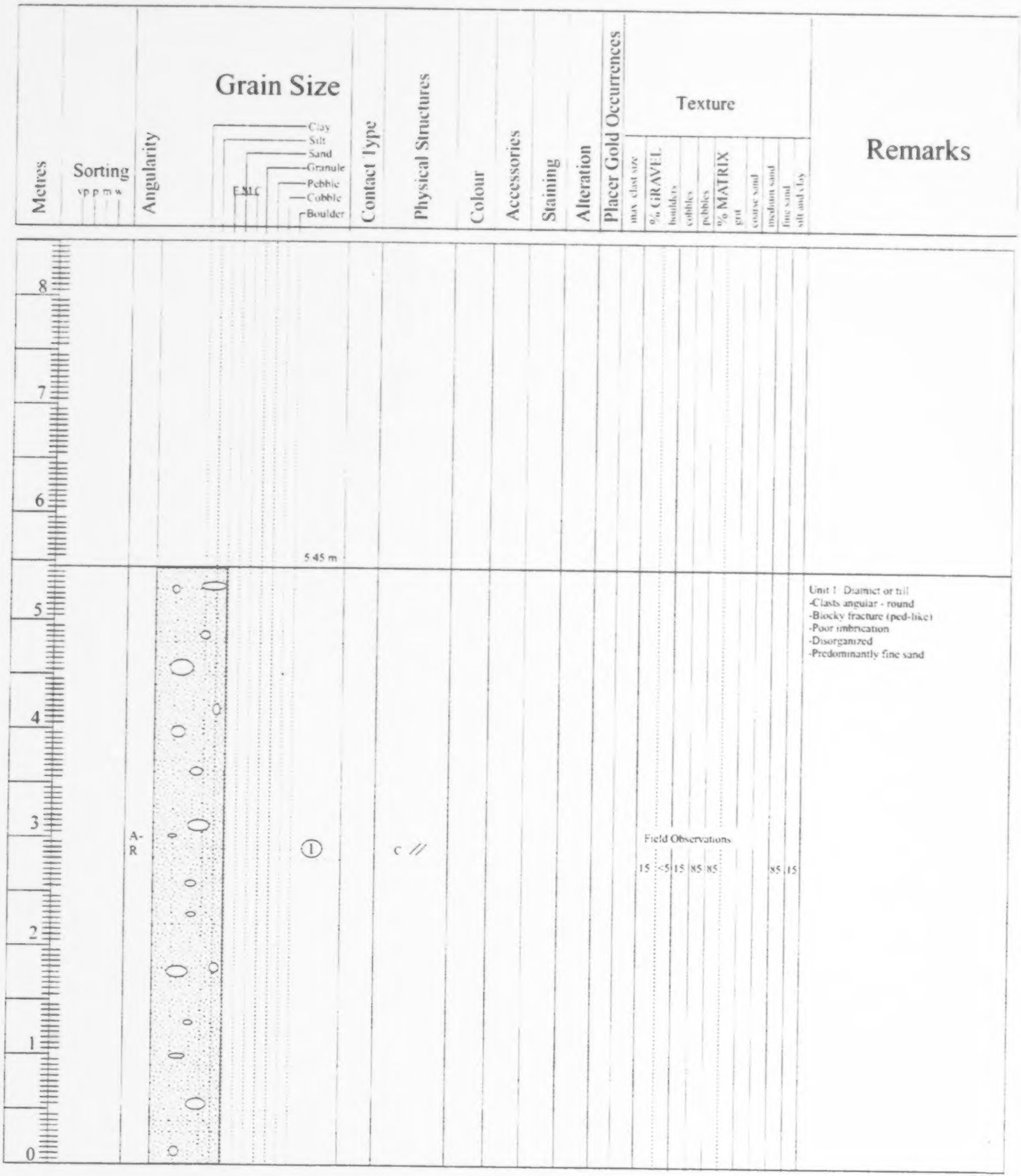
Field Observations

max. clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay
75	-	-	100	25	20	5	5	70	-	

Sieve Analysis

max. clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay
56	-	-	-	44	45	24	8	16	7	

Date: 11/07/97 Section number: MIC9703b Measured by: TA, DM Creek or River: McIntyre Creek NTS: 115 P/9
Latitude: 63°43.18' Longitude: 136°07.41' Elevation: 790? m UTM: N7066064, E0444530
Orientation: 280 ⟷ 100 Geomorphic landform: Glacial-fluvial terrace



Unit 1: Diamict or till
-Clasts angular - round
-Blocky fracture (ped-like)
-Poor imbrication
-Disorganized
-Predominantly fine sand

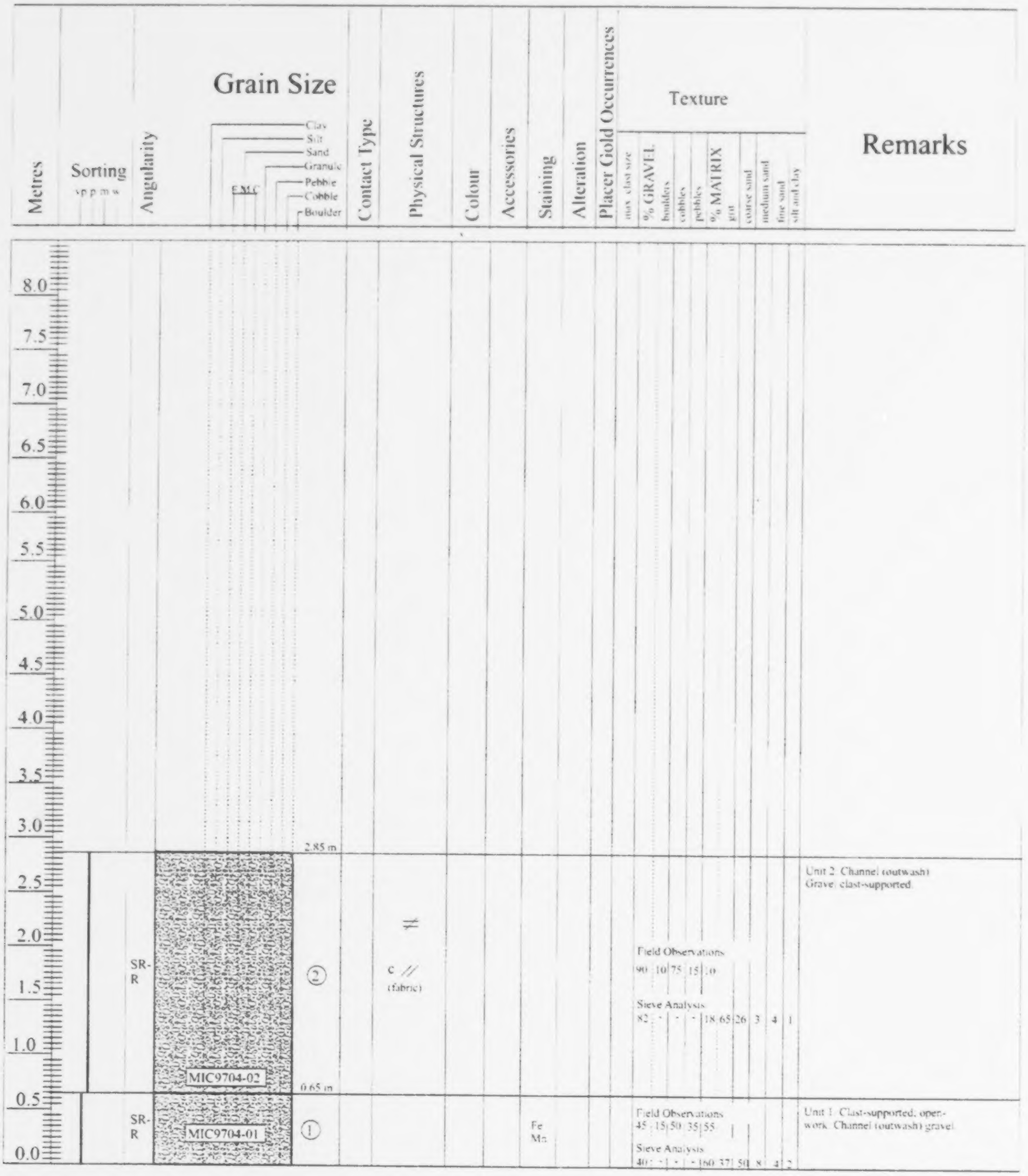
Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics

░ Sand ▨ Diamicton ∠ Cross-stratified ∠ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 11/07/97 Section number: MIC9704 Measured by: TA, DM Creek or River: Minto Creek NTS: 115 P/9
Latitude: 63°42'55.7 Longitude: 136°06'55.5 UTM: E0444889, N7065593 Elevation: 3000 ft
Orientation: ______ ⟷ ______ Geomorphic landform: McConnell outwash



Field Observations
90 | 10 | 75 | 15 | 10

Sieve Analysis
82 | - | - | - | 18 | 65 | 26 | 3 | 4 | 1

Unit 2: Channel (outwash) Gravel: clast-supported.

Field Observations
45 | 15 | 50 | 35 | 55

Sieve Analysis
40 | - | - | - | 60 | 37 | 50 | 8 | 4 | 2

Unit 1: Clast-supported; open-work. Channel (outwash) gravel.

Legend

Mud (Silt/clay) ▨ Gravel ☰ Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics

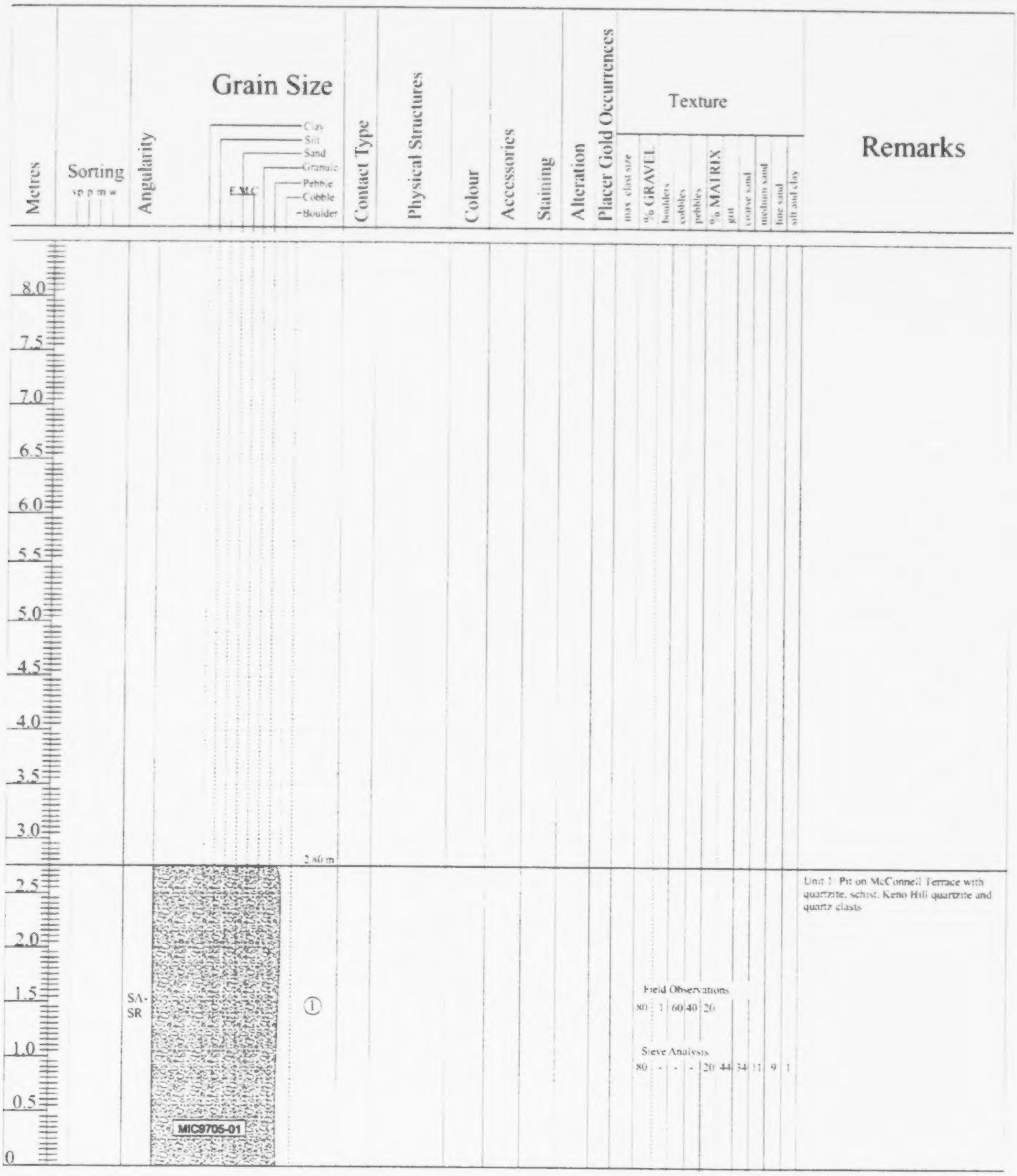
Sand ▨ Diamicton ⊿ Cross-stratified ⌓ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 11/06/97 Section number: MIC9705 Measured by: TA, DM Creek or River: Minto Creek NTS: 115P/9

Latitude: 63°42'55.7" Longitude: 136°06'55.5" Elevation: 2300 ft UTM: 444889E, 7065593N

Orientation: ______ ⟷ ______ Geomorphic landform: McConnell Outwash Terrace



Unit 1: Pit on McConnell Terrace with quartzite, schist, Keno Hill quartzite and quartz clasts

Field Observations

80 1 60 40 20

Sieve Analysis

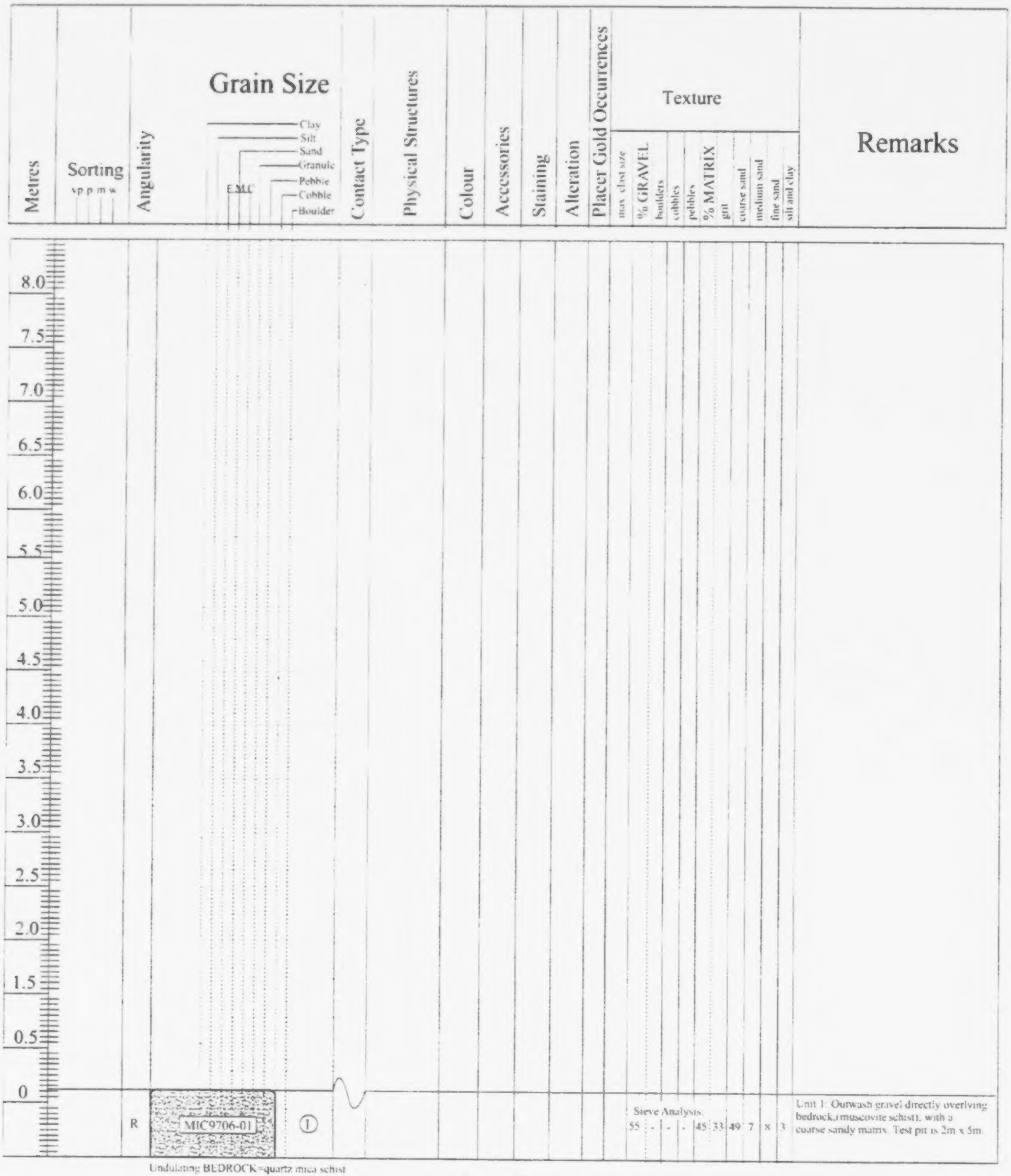
80 - - - 20 44 34 11 9 1

Legend

- ░ Mud (Silt/clay)
- ▨ Gravel
- = Planar stratified
- ≠ Massive
- // Imbricate
- ⌒ Ripples
- ⅄ Organics
- ░ Sand
- ▨ Diamicton
- ⌐ Cross-stratified
- ⌐ Trough cross-stratified
- ◡ Fossils
- \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 11/06/97 Section number: MIC9706 Measured by: TA, DM Creek or River: Minto Creek NTS: 115P/9
Latitude: 63°42'55.7" Longitude: 136°06'55.5" Elevation: 2300 ft UTM: 444889E, 7065593N
Orientation: ______ ⟷ ______ Geomorphic landform: McConnell Outwash Terrace



Sieve Analysis:

% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay
55	-	-	-	45	33	49	7	8	3

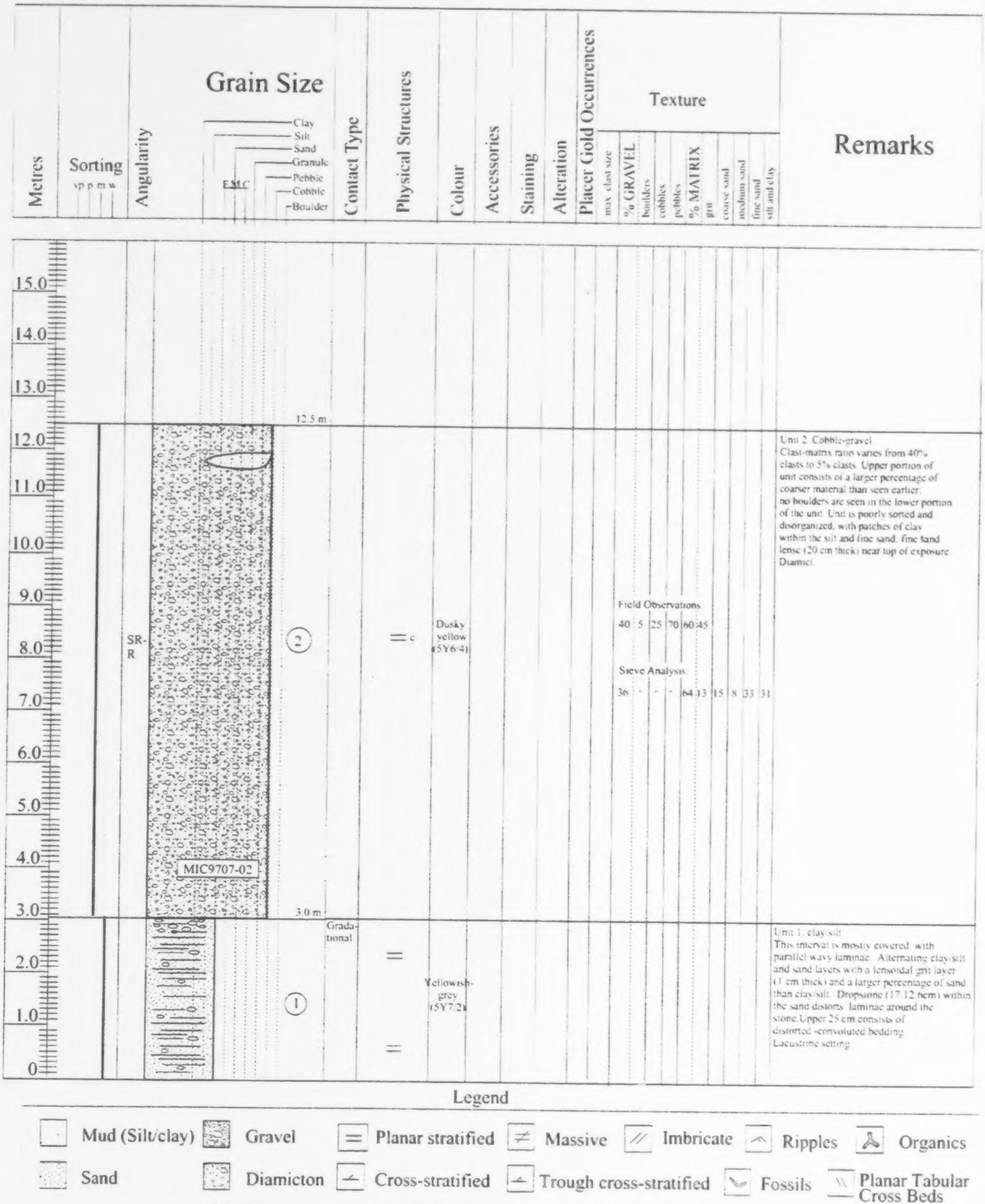
Unit 1: Outwash gravel directly overlying bedrock (muscovite schist), with a coarse sandy matrix. Test pit is 2m x 5m.

Legend

⬚ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
⬚ Sand	▨ Diamicton	∸ Cross-stratified	⏊ Trough cross-stratified	◡ Fossils	\\ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 14/07/97 Section number: MIC9707 Measured by: TA, MS Creek or River: McIntyre Creek NTS: 115 P/9
Latitude: 63°43'14.0" Longitude: 136°07'14.7 Elevation: 746 m UTM: N7066082, E0444558
Orientation: 305 ⟷ 125 Geomorphic landform: Glacial-fluvial terrace



Field Observations

40 | 5 | 25 | 70 | 60 | 45

Sieve Analysis

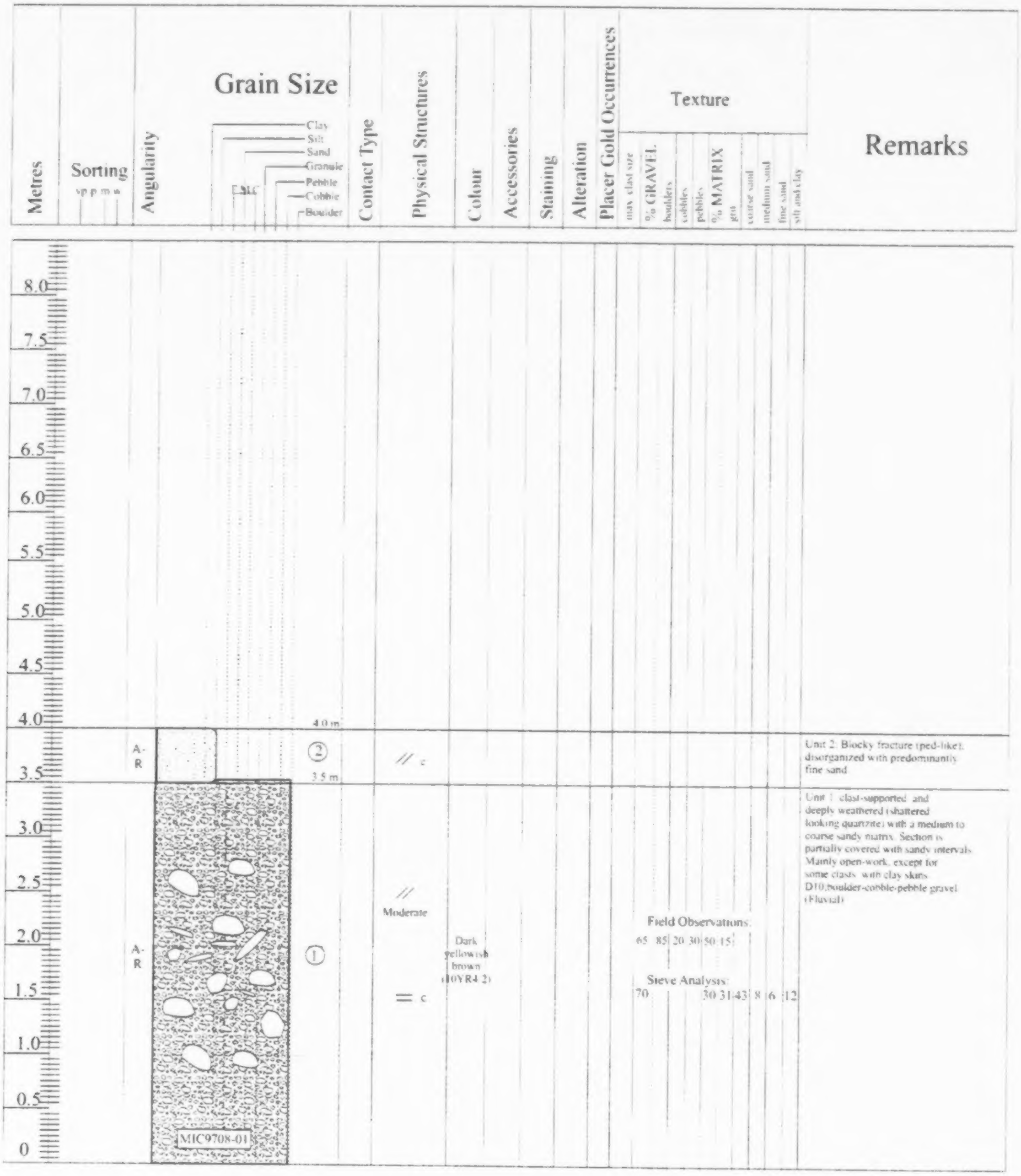
36 | - | - | - | 64 | 13 | 15 | 8 | 33 | 31

Unit 2 Cobble-gravel
Clast-matrix ratio varies from 40% clasts to 5% clasts. Upper portion of unit consists of a larger percentage of coarser material than seen earlier; no boulders are seen in the lower portion of the unit. Unit is poorly sorted and disorganized, with patches of clay within the silt and fine sand, fine sand lense (20 cm thick) near top of exposure. Diamict.

Unit 1: clay/silt
This interval is mostly covered with parallel wavy laminae. Alternating clay/silt and sand layers with a lensoidal grit layer (1 cm thick) and a larger percentage of sand than clay/silt. Dropstone (17.12.6cm) within the sand distorts laminae around the stone. Upper 25 cm consists of distorted -convoluted bedding. Lacustrine setting.

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 14/07/97 Section number: MIC9708 Measured by: TA, MS Creek or River: Minto Creek NTS: 115 P/9
Latitude: 63°42'18.5" Longitude: 136°07'57.9" Elevation: 2350 ft UTM: N7064460, E0444012
Orientation: 221° ⟷ 041° Geomorphic landform: Glacial-fluvial terrace



Unit 2: Blocky fracture (ped-like), disorganized with predominantly fine sand

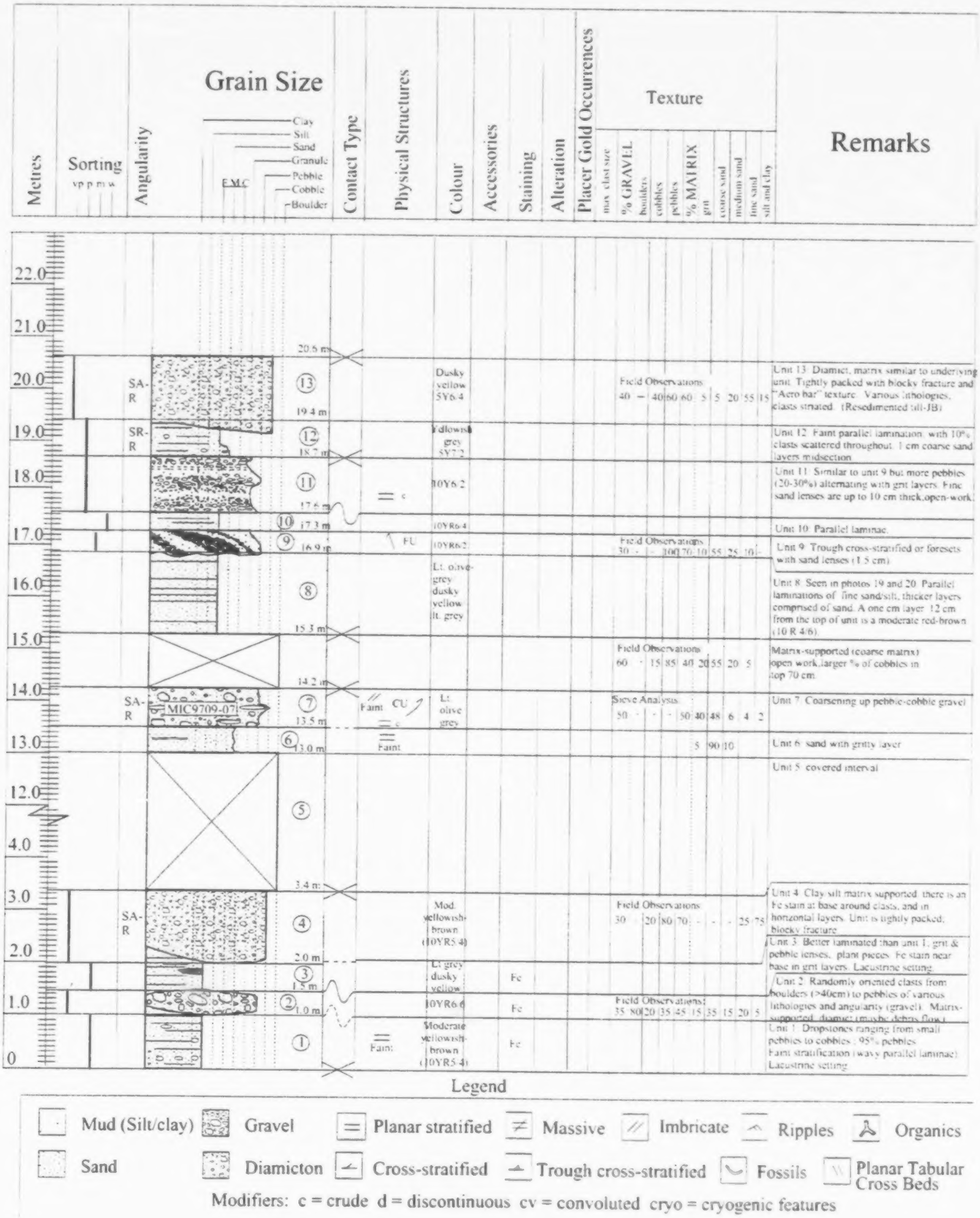
Unit 1: clast-supported and deeply weathered (shattered looking quartzite) with a medium to course sandy matrix. Section is partially covered with sandy intervals. Mainly open-work, except for some clasts with clay skins. D10;boulder-cobble-pebble gravel (Fluvial)

Legend

⬚ Mud (Silt/clay)	▩ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
░ Sand	▨ Diamicton	⊥ Cross-stratified	⊥ Trough cross-stratified	◡ Fossils	\\ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 15/07/97 Section number: MIC9709 Measured by: TA, MS Creek or River: McIntyre Creek NTS: 115 P/9
Latitude: 63°42'13.0" Longitude: 136°08'2.3" Elevation: 749 m UTM: E0443948, N7064291
Orientation: 025 ⟷ 205 Geomorphic landform: Glacial-fluvial terrace



Unit 13: Diamict, matrix similar to underlying unit. Tightly packed with blocky fracture and "Aero bar" texture. Various lithologies, clasts striated. (Resedimented till-JB)

Unit 12: Faint parallel lamination, with 10% clasts scattered throughout. 1 cm coarse sand layers midsection

Unit 11: Similar to unit 9 but more pebbles (20-30%) alternating with grit layers. Fine sand lenses are up to 10 cm thick, open-work.

Unit 10: Parallel laminae.

Unit 9: Trough cross-stratified or foresets with sand lenses (1.5 cm).

Unit 8: Seen in photos 19 and 20. Parallel laminations of fine sand/silt, thicker layers comprised of sand. A one cm layer 12 cm from the top of unit is a moderate red-brown (10 R 4/6).

Matrix-supported (coarse matrix) open work, larger % of cobbles in top 70 cm.

Unit 7: Coarsening up pebble-cobble gravel

Unit 6: sand with gritty layer

Unit 5: covered interval

Unit 4: Clay/silt matrix supported, there is an Fe stain at base around clasts, and in horizontal layers. Unit is tightly packed, blocky fracture

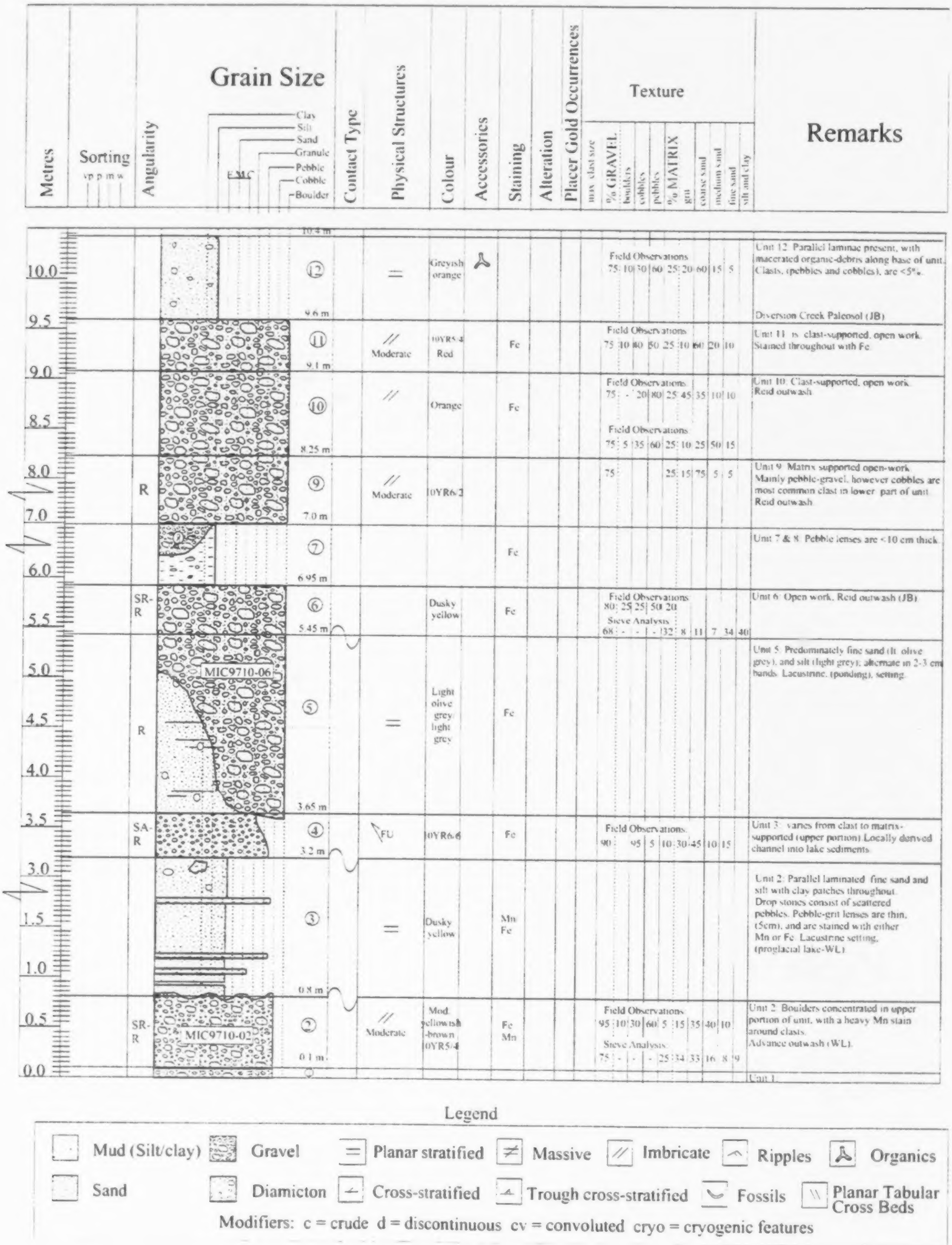
Unit 3: Better laminated than unit 1, grit & pebble lenses, plant pieces. Fe stain near base in grit layers. Lacustrine setting.

Unit 2: Randomly oriented clasts from boulders (>40cm) to pebbles of various lithologies and angularity (gravel). Matrix-supported diamict (maybe debris flow)

Unit 1: Dropstones ranging from small pebbles to cobbles; 95% pebbles. Faint stratification (wavy parallel laminae). Lacustrine setting.

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 16/07/97 Section number: MIC9710 Measured by: TA, MS Creek or River: Minto Creek NTS: 115P/9
Latitude: 63°42.02 Longitude: 136°07.86 Elevation: 2003 ft (610 m) UTM: N7063913, E0444077
Orientation: 190° ◁——▷ 010° Geomorphic landform:



Unit 12: Parallel laminae present, with macerated organic-debris along base of unit. Clasts, (pebbles and cobbles), are <5%.

Diversion Creek Paleosol (JB)

Unit 11 is clast-supported, open work. Stained throughout with Fe.

Unit 10: Clast-supported, open work. Reid outwash.

Unit 9: Matrix supported open-work. Mainly pebble-gravel, however cobbles are most common clast in lower part of unit. Reid outwash.

Unit 7 & 8: Pebble lenses are <10 cm thick.

Unit 6: Open work. Reid outwash (JB).

Unit 5: Predominately fine sand (lt. olive grey), and silt (light grey); alternate in 2-3 cm bands. Lacustrine, (ponding), setting.

Unit 3: varies from clast to matrix-supported (upper portion). Locally derived channel into lake sediments.

Unit 2: Parallel laminated fine sand and silt with clay patches throughout. Drop stones consist of scattered pebbles. Pebble-grit lenses are thin, (5cm), and are stained with either Mn or Fe. Lacustrine setting, (proglacial lake-WL).

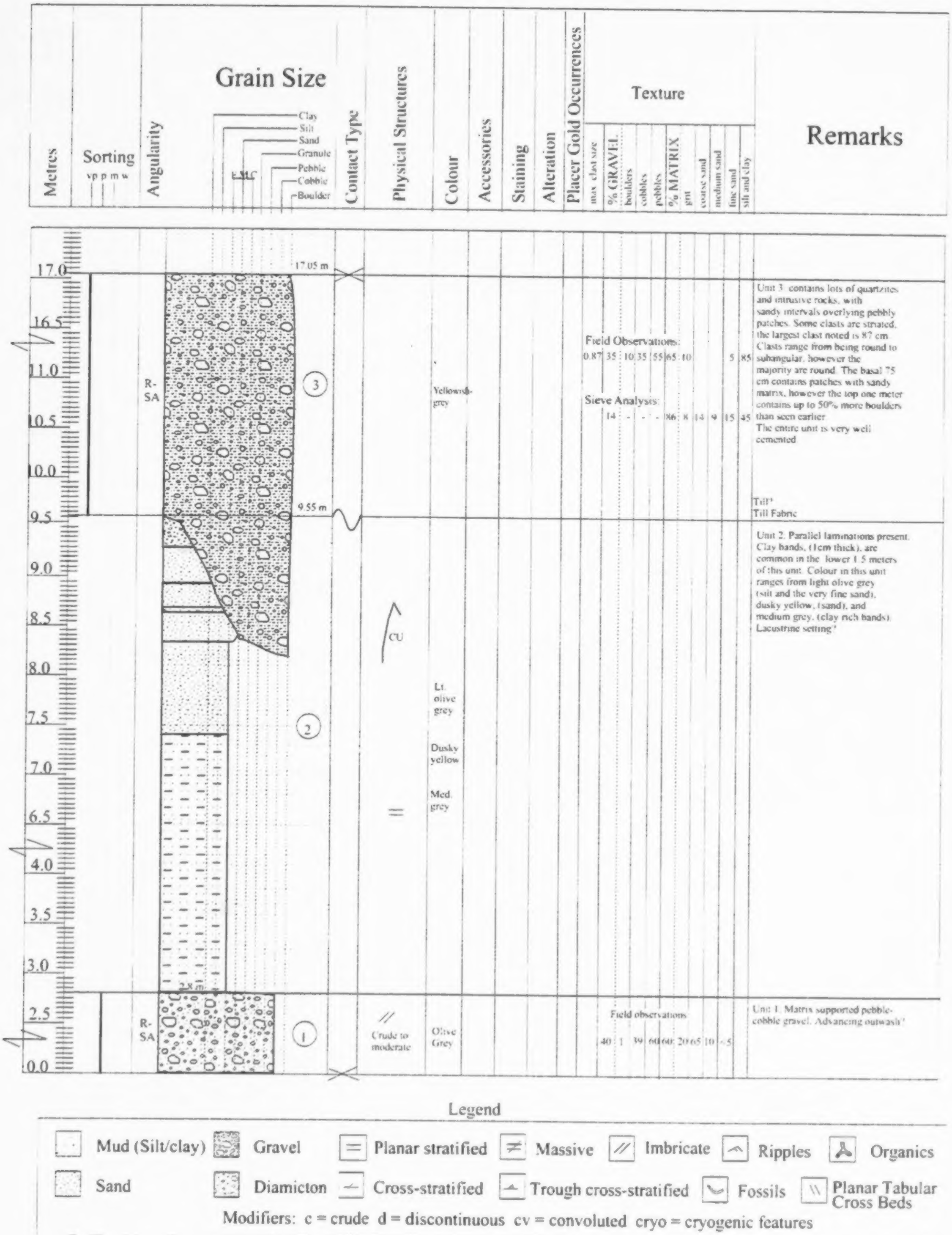
Unit 2: Boulders concentrated in upper portion of unit, with a heavy Mn stain around clasts. Advance outwash (WL).

Unit 1.

Date: 31/07/97 Section number: MIC9711 Measured by: TA, LM Creek or River: Minto Creek NTS: 115 P/9

Latitude: 63°42.208' Longitude: 136°08.108' Elevation: UTM: E0443899, N7064232

Orientation: 080 ⟷ 260 Geomorphic landform:



Field Observations:

0.87 | 35 | 10 | 35 | 55 | 65 | 10 | 5 | 85

Sieve Analysis:

14 | - | - | - | 86 | 8 | 14 | 9 | 15 | 45

Unit 3 contains lots of quartzites and intrusive rocks, with sandy intervals overlying pebbly patches. Some clasts are striated, the largest clast noted is 87 cm. Clasts range from being round to subangular, however the majority are round. The basal 75 cm contains patches with sandy matrix, however the top one meter contains up to 50% more boulders than seen earlier. The entire unit is very well cemented.

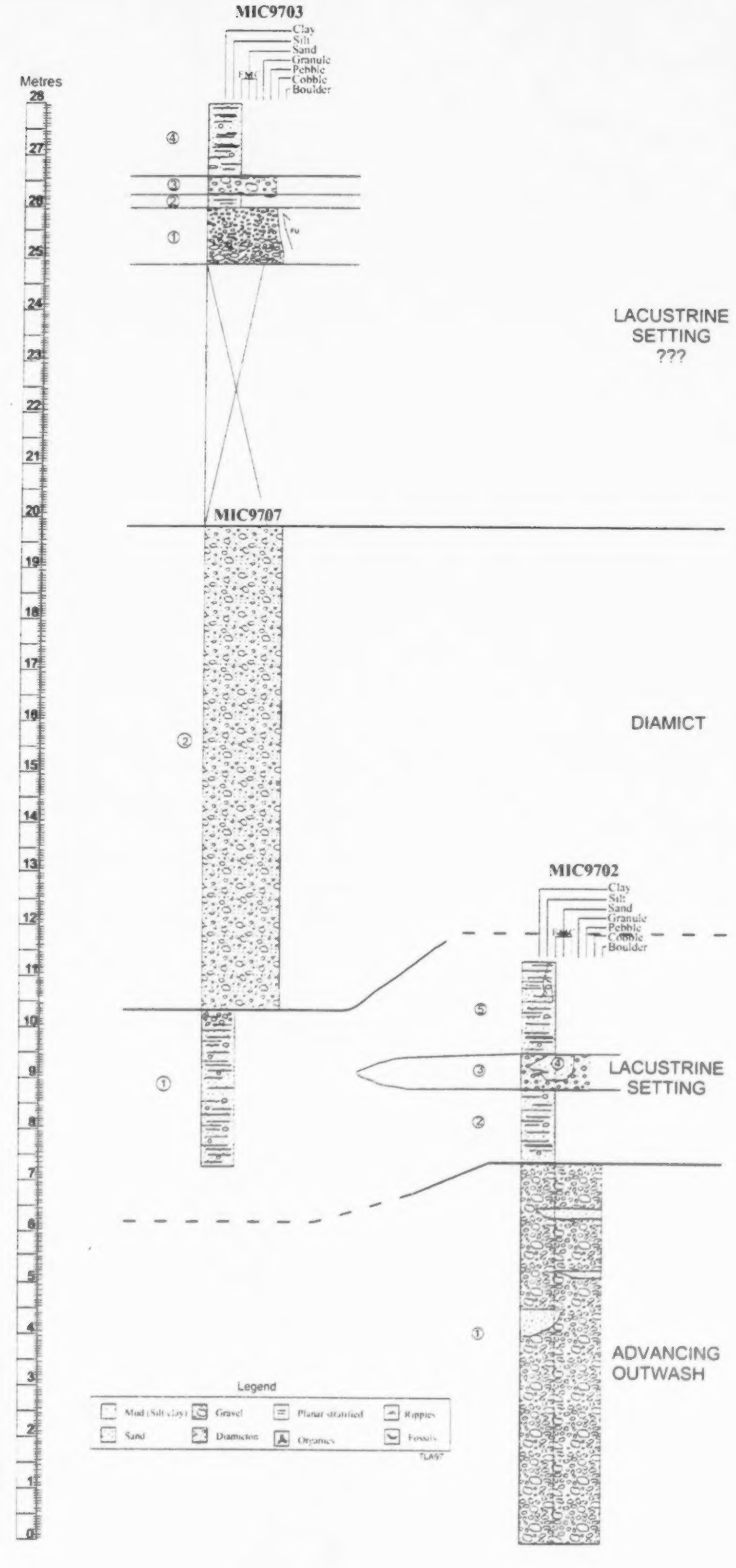
Till?
Till Fabric

Unit 2. Parallel laminations present. Clay bands, (1cm thick), are common in the lower 1.5 meters of this unit. Colour in this unit ranges from light olive grey (silt and the very fine sand), dusky yellow, (sand), and medium grey, (clay rich bands). Lacustrine setting?

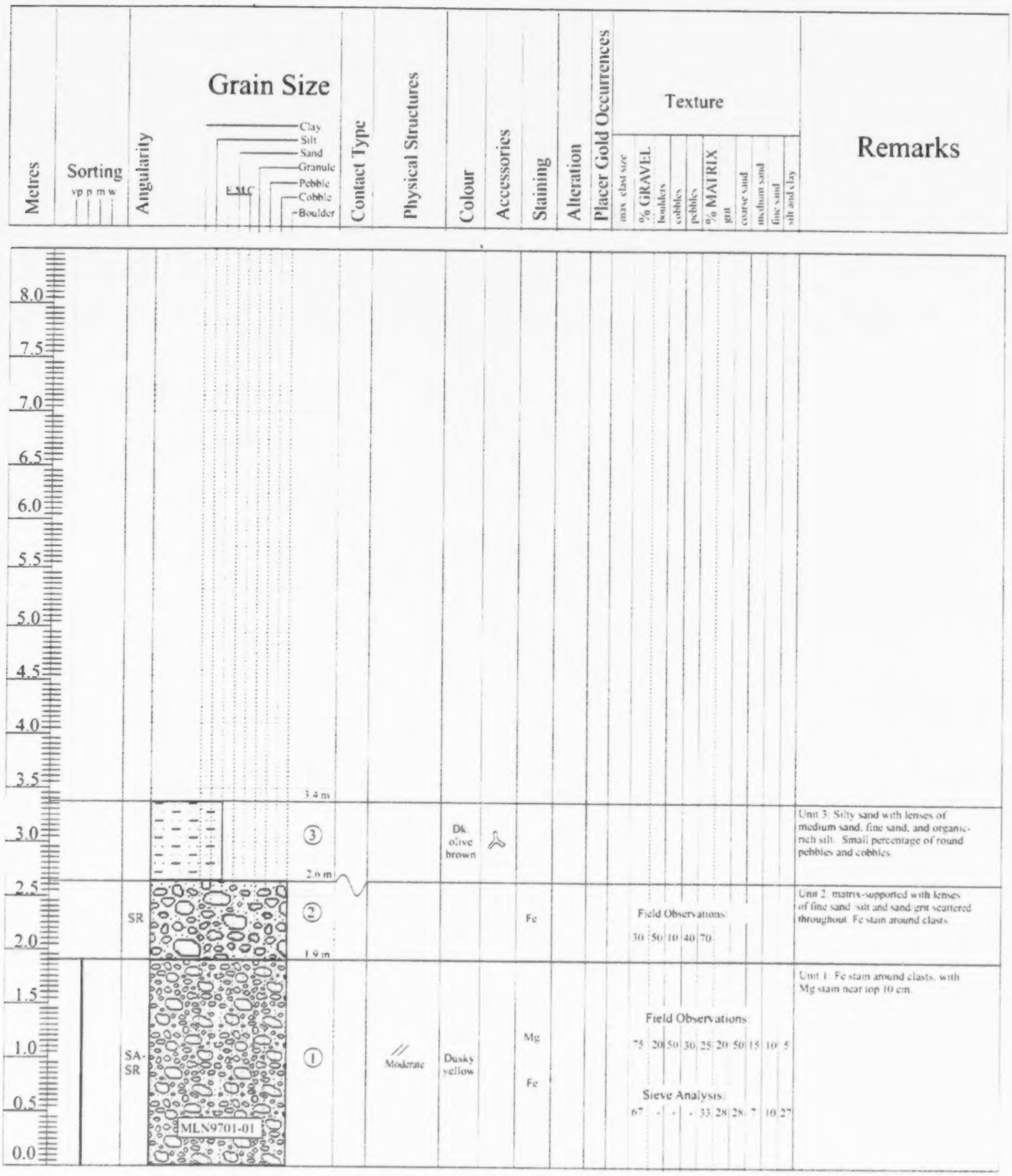
Field observations

40 | 1 | 39 | 60 | 60 | 20 | 65 | 10 | <5

Unit 1. Matrix supported pebble-cobble gravel. Advancing outwash?


MIC9703
Clay
Silt
Sand
Granule
Pebble
Cobble
Boulder
Metres
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
④
③
②
①
LACUSTRINE SETTING ???
MIC9707
DIAMICT
②
①
MIC9702
Clay
Silt
Sand
Granule
Pebble
Cobble
Boulder
⑤
④
③
②
LACUSTRINE SETTING
①
ADVANCING OUTWASH
Legend
Mud (Silt clay)
Gravel
Planar stratified
Ripples
Sand
Diamicton
Organics
Fossils
TLA97

Date: 01/08/97 Section number: MLN9701 Measured by: TA, DM Creek or River: McLagan Creek NTS: 115 P/9
Latitude: 63°42'31.8" Longitude: 136°13'23.6" Elevation: 2800 ft UTM: N7064954, E0439548
Orientation: ______ ⟵⟶ ______ Geomorphic landform: ____________



Unit 3: Silty sand with lenses of medium sand, fine sand, and organic-rich silt. Small percentage of round pebbles and cobbles.

Unit 2: matrix-supported with lenses of fine sand /silt and sand/grit scattered throughout. Fe stain around clasts.

Field Observations:
30 50 10 40 70

Unit 1: Fe stain around clasts, with Mg stain near top 10 cm.

Field Observations:
75 20 50 30 25 20 50 15 10 5

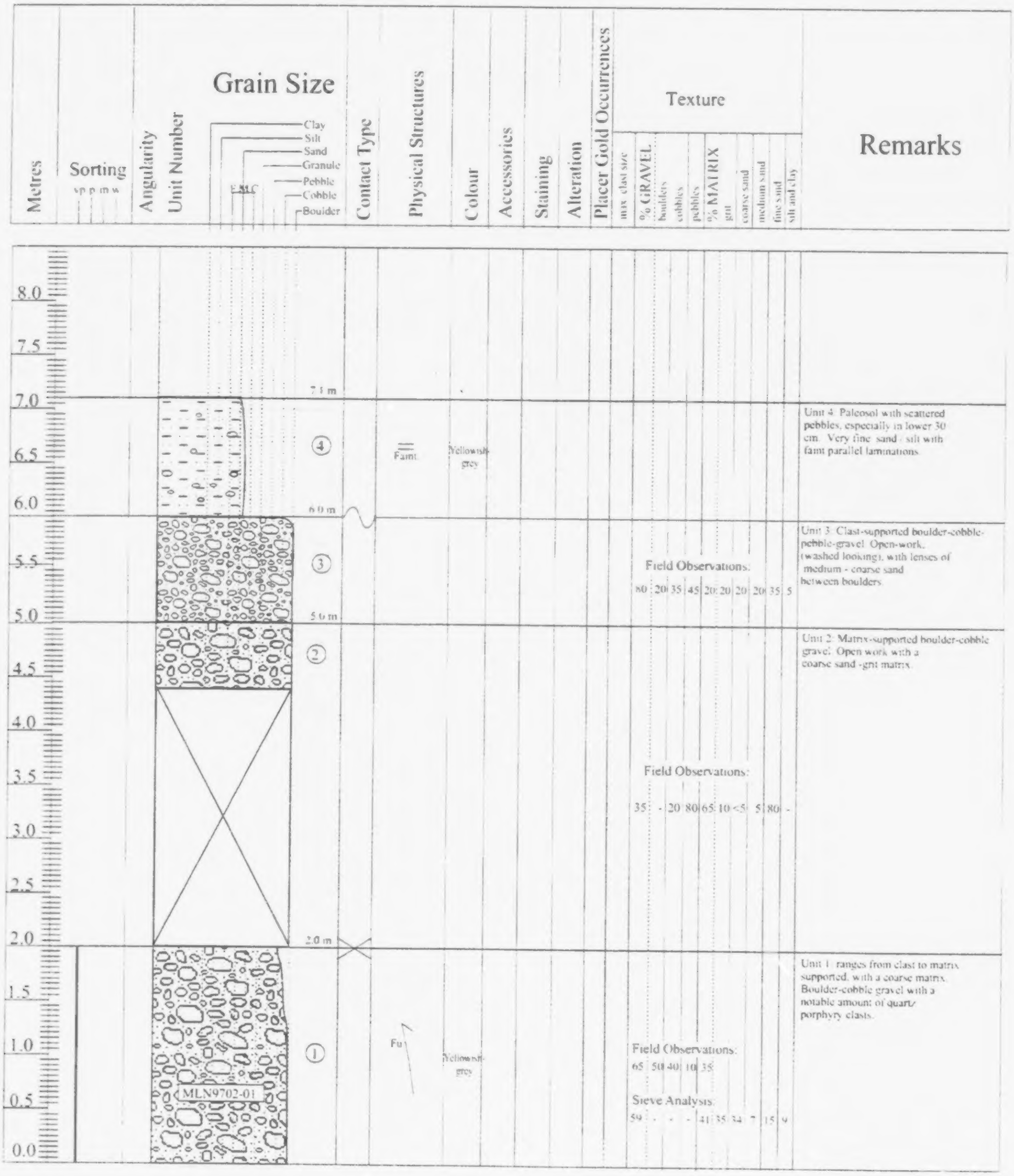
Sieve Analysis:
67 - - - 33 28 28 7 10 27

Legend

☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	Organics
▨ Sand	▨ Diamicton	Cross-stratified	Trough cross-stratified	Fossils	Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 01 08 97 Section number: MLN9702 Measured by: TA, DM Creek or River: McLagan Creek NTS: 115 P/9
Latitude: 63°41'42.3" Longitude: 136°13'34.3" Elevation: 2400 ft UTM: N7063424, E0439372
Orientation: ______ ⟷ ______ Geomorphic landform: ______



Unit 4: Paleosol with scattered pebbles, especially in lower 30 cm. Very fine sand / silt with faint parallel laminations.

Unit 3: Clast-supported boulder-cobble-pebble-gravel. Open-work, (washed looking), with lenses of medium - coarse sand between boulders.

Field Observations:
80 20 35 45 20 20 20 20 35 5

Unit 2: Matrix-supported boulder-cobble gravel. Open work with a coarse sand -grit matrix.

Field Observations:
35 - 20 80 65 10 <5 5 80 -

Unit 1: ranges from clast to matrix supported, with a coarse matrix. Boulder-cobble gravel with a notable amount of quartz porphyry clasts.

Field Observations:
65 50 40 10 35

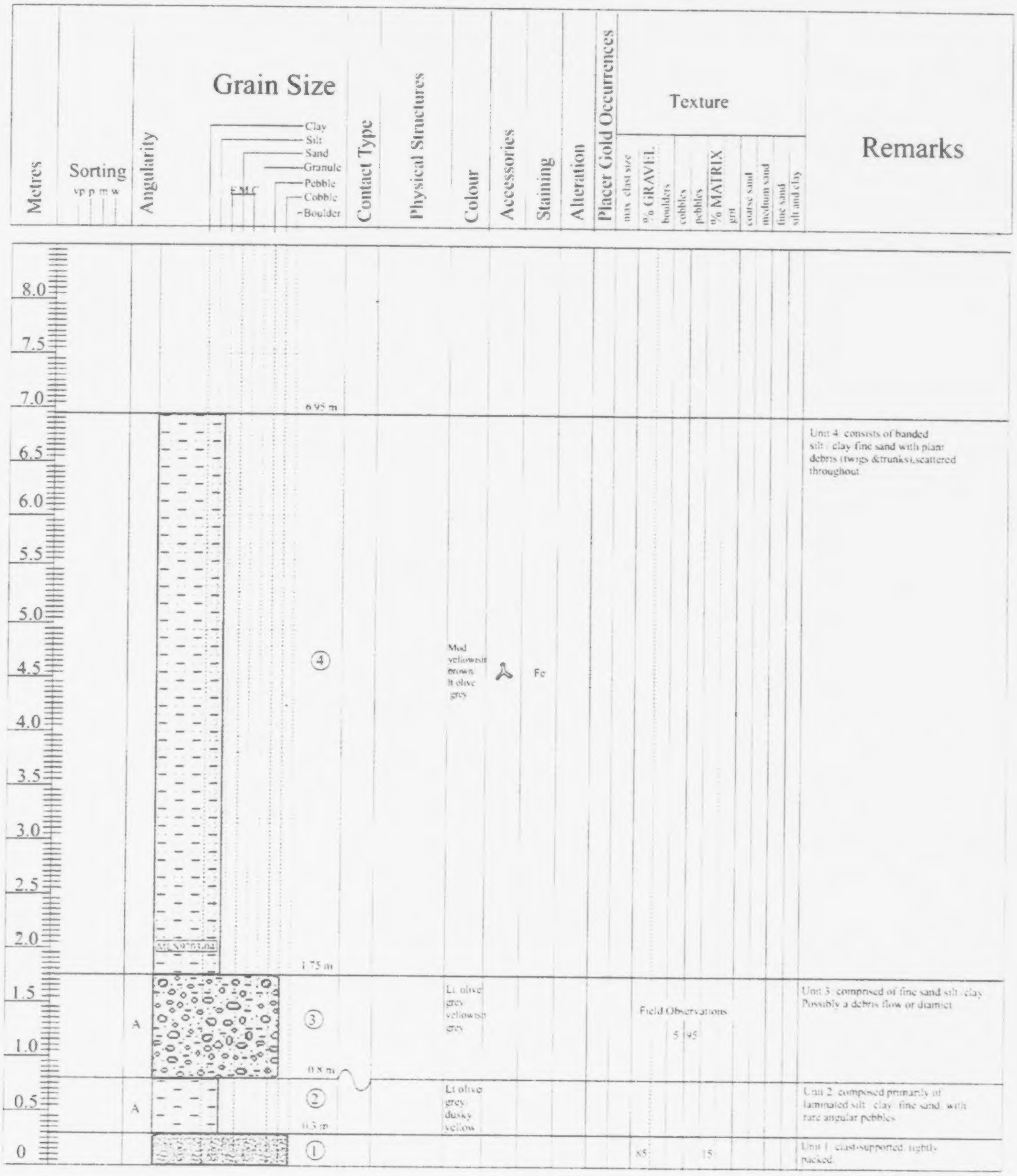
Sieve Analysis:
59 - - - 41 35 34 7 15 9

Legend

☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
☐ Sand	▨ Diamicton	⟋ Cross-stratified	⌒ Trough cross-stratified	◡ Fossils	\\\\ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 01/08/97 Section number: MLN9703 Measured by: TA, DM Creek or River: McLagan Creek NTS 115 P/9
Latitude: 63°41'26.1" Longitude: 136°13'7.7" Elevation: 2200 ft UTM: E0439728, N7062728
Orientation: ______ ⟷ ______ Geomorphic landform: ______



Unit 4: consists of banded silt / clay fine sand with plant debris (twigs &trunks),scattered throughout.

Unit 3: comprised of fine sand silt / clay Possibly a debris flow or diamict

Unit 2: composed primarily of laminated silt / clay / fine sand, with rare angular pebbles

Unit 1: clast-supported, tightly packed.

Legend

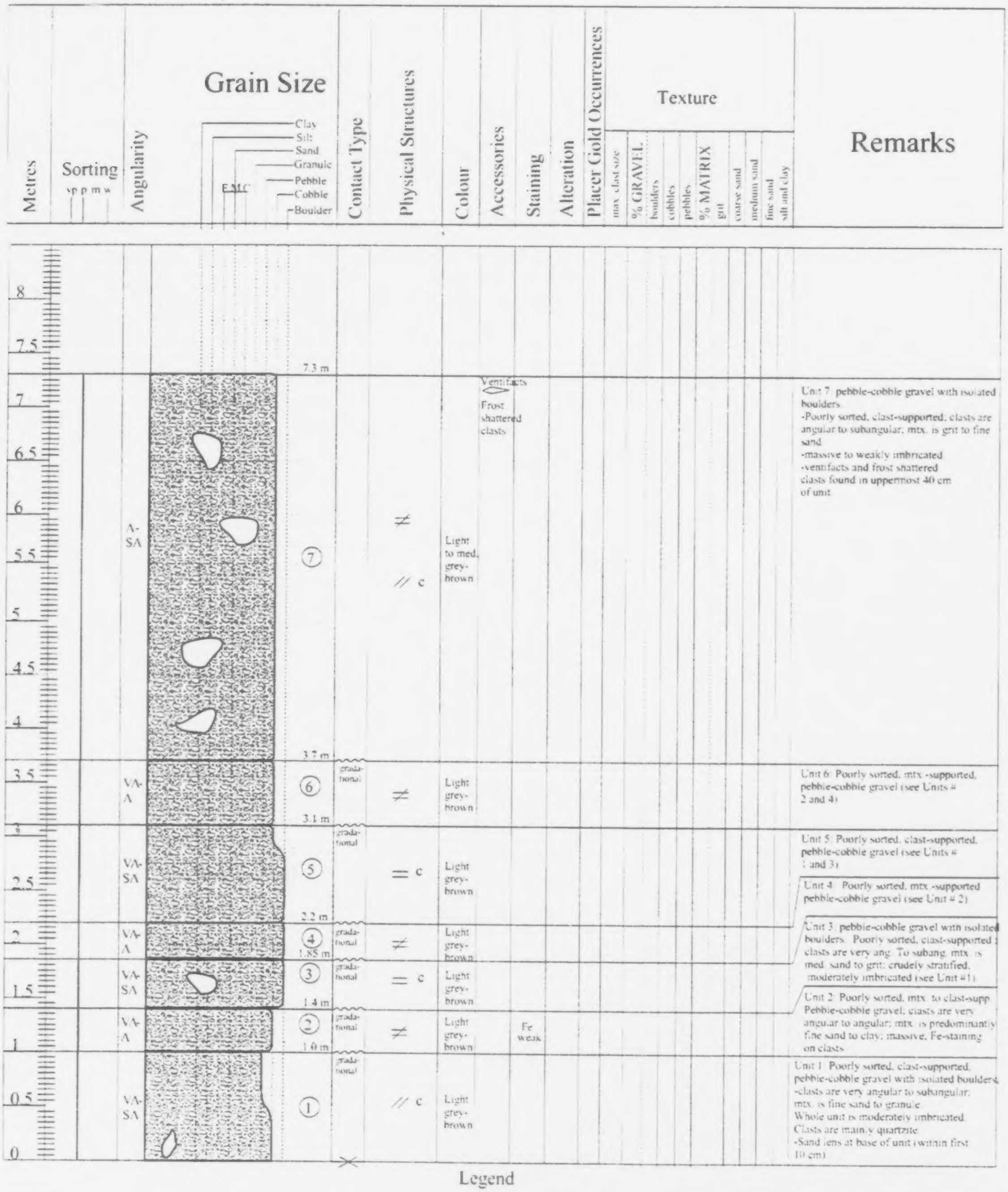
- ☐ Mud (Silt/clay)
- ▨ Gravel
- ☰ Planar stratified
- ≠ Massive
- // Imbricate
- ⌒ Ripples
- ⅄ Organics
- ☐ Sand
- ▨ Diamicton
- ∠ Cross-stratified
- ⌣ Trough cross-stratified
- ◡ Fossils
- \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 20 08 96 Section number: GILL 3 Measured by: LW/BL Creek or River: Gill Gulch NTS: 106D4

Latitude 64°01'38''N Longitude: 135°51'11''W Elevation: 2415 UTM: 458250E,7100175N

Orientation: 235° ⟷ 055° upstream Geomorphic landform: Periglacial Fan



Unit 7 pebble-cobble gravel with isolated boulders
-Poorly sorted, clast-supported, clasts are angular to subangular; mtx. is grit to fine sand
-massive to weakly imbricated
-ventifacts and frost shattered clasts found in uppermost 40 cm of unit

Unit 6: Poorly sorted, mtx.-supported, pebble-cobble gravel (see Units # 2 and 4)

Unit 5: Poorly sorted, clast-supported, pebble-cobble gravel (see Units # 1 and 3)

Unit 4 Poorly sorted, mtx.-supported pebble-cobble gravel (see Unit # 2)

Unit 3: pebble-cobble gravel with isolated boulders. Poorly sorted, clast-supported; clasts are very ang. To subang. mtx. is med. sand to grit; crudely stratified, moderately imbricated (see Unit #1)

Unit 2: Poorly sorted, mtx. to clast-supp. Pebble-cobble gravel; clasts are very angular to angular; mtx. is predominantly fine sand to clay; massive, Fe-staining on clasts

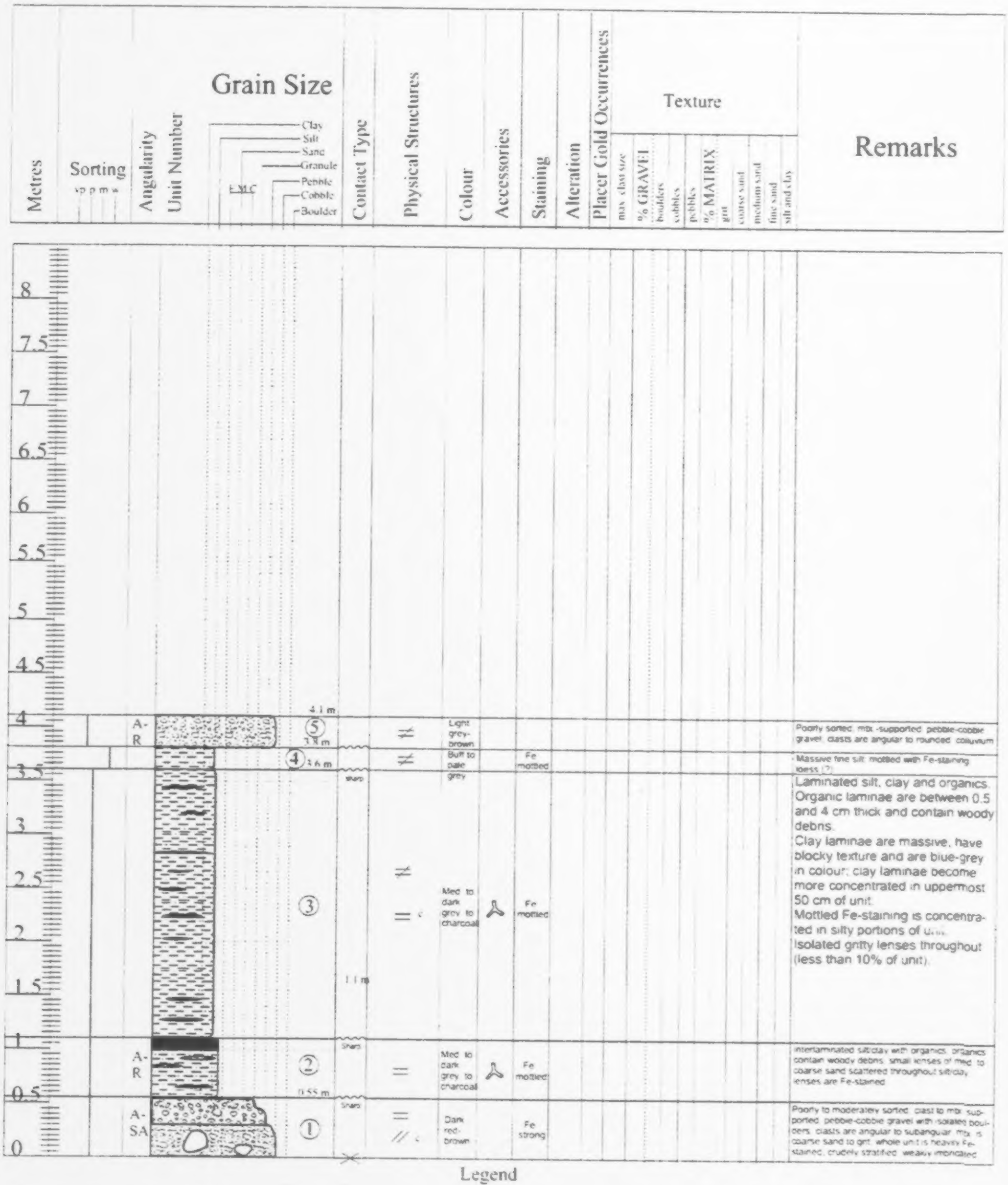
Unit 1: Poorly sorted, clast-supported, pebble-cobble gravel with isolated boulders
-clasts are very angular to subangular; mtx. is fine sand to granule.
Whole unit is moderately imbricated.
Clasts are mainly quartzite
-Sand lens at base of unit (within first 10 cm)

Legend

☐ Mud (Silt/clay)
▨ Gravel
= Planar stratified
≠ Massive
// Imbricate
⌒ Ripples
Organics
▨ Sand
▨ Diamicton
Cross-stratified
Trough cross-stratified
Fossils
\\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 21 08 96 Section number: GILL4 Measured by: LW/FH Creek or River: Gill Gulch NTS: 106D4
Latitude: 64°01'41''N Longitude: 135°51'15''W Elevation: 2440 UTM: 458200E.7100275N
Orientation: 160° ⟷ 340° upstream Geomorphic landform: Alluvial Plain/Alluvial Fan



Poorly sorted, mtx.-supported, pebble-cobble gravel, clasts are angular to rounded, colluvium

Massive fine silt mottled with Fe-staining loess (?)

Laminated silt, clay and organics.
Organic laminae are between 0.5 and 4 cm thick and contain woody debris.
Clay laminae are massive, have blocky texture and are blue-grey in colour; clay laminae become more concentrated in uppermost 50 cm of unit.
Mottled Fe-staining is concentrated in silty portions of unit.
Isolated gritty lenses throughout (less than 10% of unit).

Interlaminated silt/clay with organics, organics contain woody debris, small lenses of med. to coarse sand scattered throughout silt/clay, lenses are Fe-stained

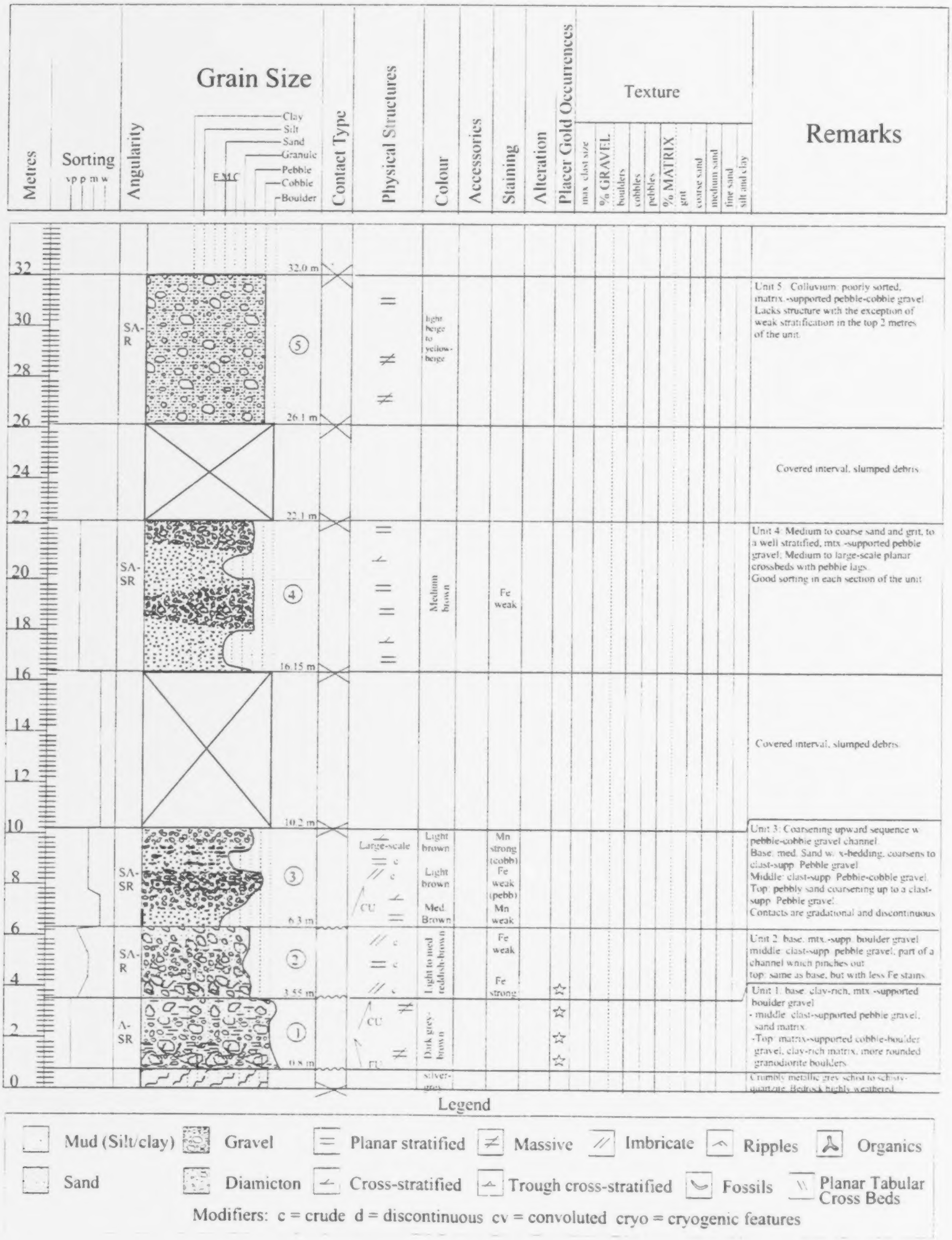
Poorly to moderately sorted, clast to mtx. supported, pebble-cobble gravel with isolated boulders, clasts are angular to subangular, mtx. is coarse sand to grit, whole unit is heavily Fe-stained, crudely stratified, weakly imbricated

Legend

Mud (Silt/clay) | Gravel | ═ Planar stratified | ≠ Massive | // Imbricate | Ripples | Organics
Sand | Diamicton | Cross-stratified | Trough cross-stratified | Fossils | Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 17/06/97 Section number: LW-97-01 Measured by: LW, LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°00'55"N Longitude: 135°50'53"W Elevation: 2500 ft. UTM: 0458542E,7098796N
Orientation: 176° ⟷ 356° upstream Geomorphic landform: Alluvial fan / Colluvial Apron



Unit 5: Colluvium: poorly sorted, matrix.-supported pebble-cobble gravel. Lacks structure with the exception of weak stratification in the top 2 metres of the unit.

Covered interval, slumped debris.

Unit 4: Medium to coarse sand and grit, to a well stratified, mtx.-supported pebble gravel; Medium to large-scale planar crossbeds with pebble lags.
Good sorting in each section of the unit

Covered interval, slumped debris.

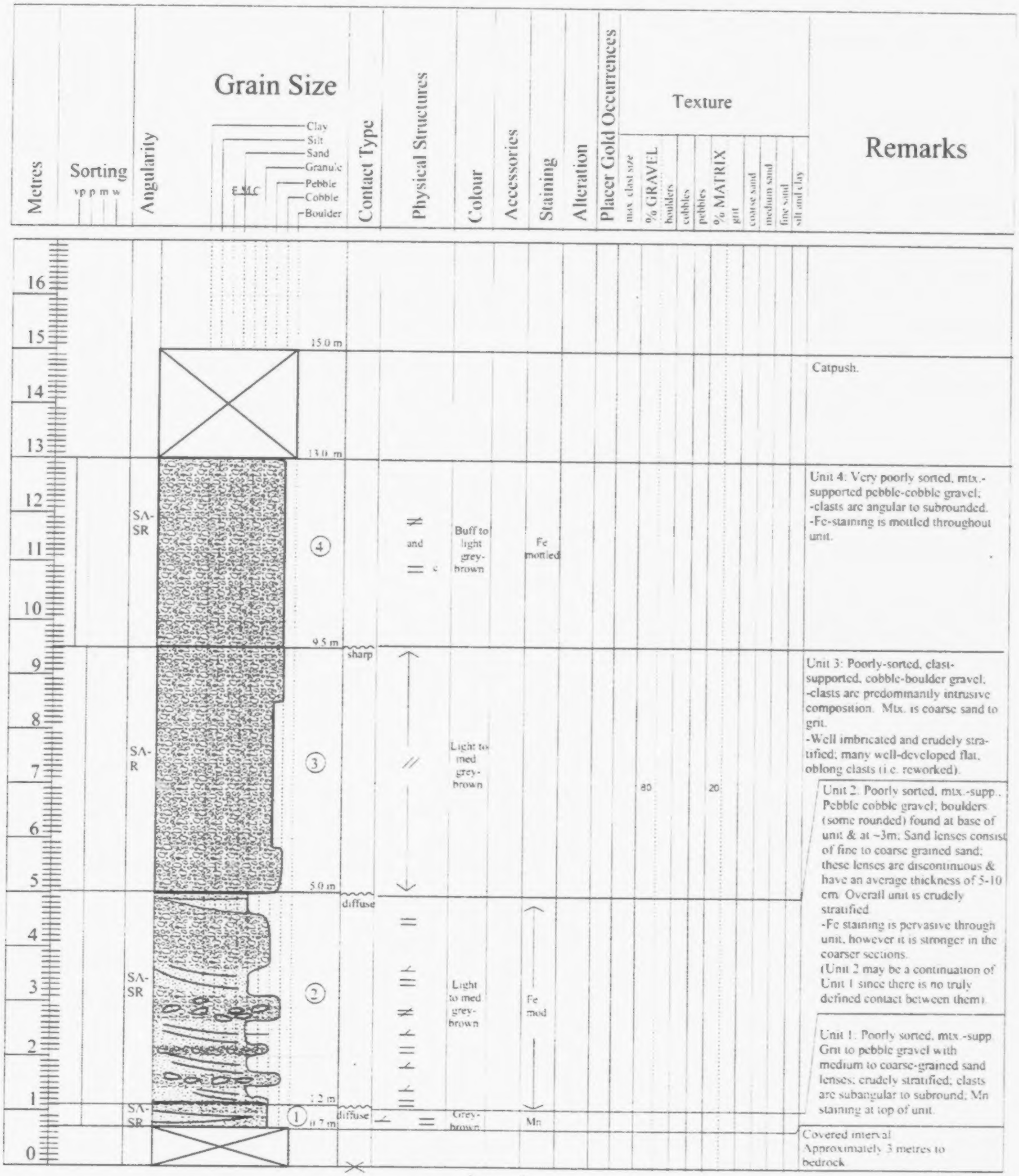
Unit 3: Coarsening upward sequence w pebble-cobble gravel channel.
Base: med. Sand w. x-bedding, coarsens to clast-supp. Pebble gravel.
Middle: clast-supp. Pebble-cobble gravel.
Top: pebbly sand coarsening up to a clast-supp. Pebble gravel.
Contacts are gradational and discontinuous

Unit 2: base: mtx.-supp. boulder gravel
middle: clast-supp. pebble gravel, part of a channel which pinches out
top: same as base, but with less Fe stains.

Unit 1: base: clay-rich, mtx.-supported boulder gravel
- middle: clast-supported pebble gravel, sand matrix.
-Top: matrix-supported cobble-boulder gravel, clay-rich matrix, more rounded granodiorite boulders

Crumbly metallic grey schist to schisty-quartzite. Bedrock highly weathered.

Date: 24 / 6 / 97 Section number: LW-97-02 Measured by: LW/LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64° 00'48''N Longitude: 135 °50'53''W Elevation: 2475 ft UTM: 458525E,7098700N
Orientation: 189 ° ⟷ 009 ° upstream Geomorphic landform: Glacial Fluvial Complex/Colluvial Apron



Catpush.

Unit 4: Very poorly sorted, mtx.-supported pebble-cobble gravel;
-clasts are angular to subrounded.
-Fe-staining is mottled throughout unit.

Unit 3: Poorly-sorted, clast-supported, cobble-boulder gravel.
-clasts are predominantly intrusive composition. Mtx. is coarse sand to grit.
-Well imbricated and crudely stratified; many well-developed flat, oblong clasts (i.e. reworked).

Unit 2: Poorly sorted, mtx.-supp., Pebble cobble gravel; boulders (some rounded) found at base of unit & at ~3m; Sand lenses consist of fine to coarse grained sand; these lenses are discontinuous & have an average thickness of 5-10 cm. Overall unit is crudely stratified.
-Fe staining is pervasive through unit, however it is stronger in the coarser sections.
(Unit 2 may be a continuation of Unit 1 since there is no truly defined contact between them).

Unit 1: Poorly sorted, mtx.-supp. Grit to pebble gravel with medium to coarse-grained sand lenses; crudely stratified; clasts are subangular to subround; Mn staining at top of unit.

Covered interval
Approximately 3 metres to bedrock

Legend

☐	Mud (Silt/clay)	▨	Gravel	☰	Planar stratified	≠	Massive	//	Imbricate	⌒	Ripples
▨	Sand	▨	Diamicton	∠	Cross-stratified	∠	Trough cross-stratified	◡	Fossils	\\	Planar Tabular Cross Beds

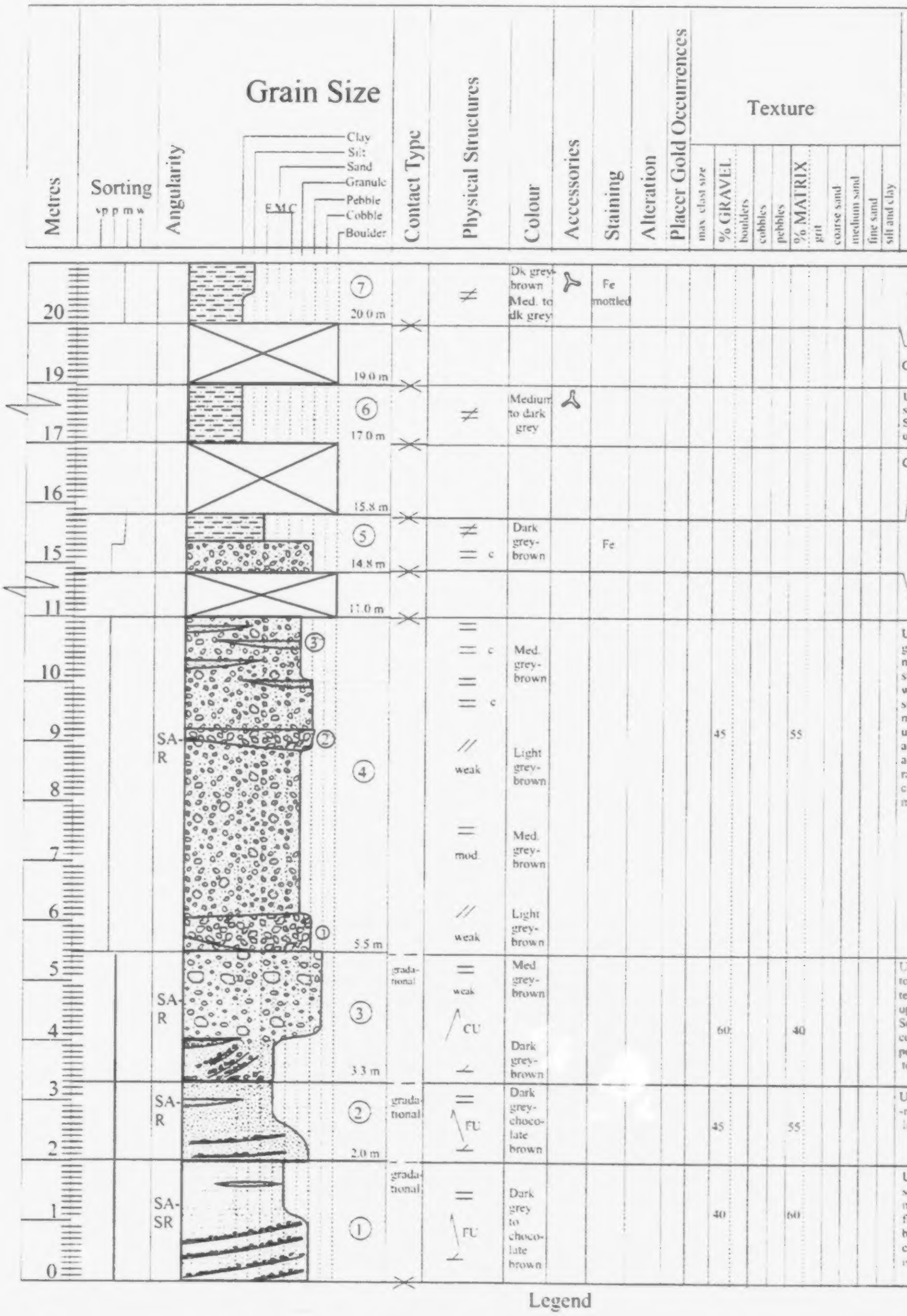
Organics

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 25/06/97 Section number: LW-97-03 Measured by: LW/LM Creek or River: Haggart Creek NTS: 106D4

Latitude: 64°00'51''N Longitude: 135°50'53''W Elevation: 2485 ft UTM: 458525E,7098800N

Orientation: 201° ⟷ 021° upstream Geomorphic landform: Alluvial Fan/Colluvial Apron



Remarks

TOP: Covered interval, slumped debris

Unit 7: Lower half of unit is medium to dark grey massive silty clay. Clay grades into poorly sorted coarse sand to grit with isolated pebbles; uppermost part of unit is mottled with Fe-staining

Covered interval, slumped debris.

Unit 6: Medium to dark grey, massive silty clay; blocky texture. Stringers of black organics in uppermost 80 cm of unit.

Covered interval, slumped debris.

Unit 5: Bottom= poorly sorted,mtx.-Supported, granule-pebble gravel. Remaining part of the unit consists of massive silts and clays with isolated gritty lenses; silts also contain Fe-stained stringers of fine to med. sand throughout; lenses are contorted and bent due to cryoturbation.

Covered interval, slumped debris

Unit 4: Poorly sorted, mtx.-supported, granule-pebble gravel with isolated cobbles; matrix is medium to coarse sand;crudely stratified.(1), (2) and (3) are channel fills which consist of poorly sorted, clast-supported, pebble gravel; gravel is moderately imbricated. Uppermost part of unit contains numerous sand lenses, lenses are well stratified, between 2-20 cm thick and consist of fine to medium sand. Colour ranges from light grey-brown in pebble channel fills, to medium grey-brown in matrix- supported granule-pebble gravel.

Unit 3: Bottom part of unit: planar stratified to planar cross-bedded med. sand with isolated pebbles and cobbles. Sands coarsen upwards to a poorly to mod. sorted, mtx.-Supported grit-pebble gravel with isolated cobbles. Small isolated clast-supported, pebble-cobble gravel channels located towards base of unit.

Unit 2: Same as unit #1 except more pebbly; -matrix is grit to med. sand. This unit likely of same facies as #1.

Unit 1: Poor- to mod. sorted fining up sequence from mtx.-supp. pebble gravel to med. & coarse sand. Few small, isolated fine sand lenses. Large scale planar cross-bed sets at base of unit, sets consist of 5-10 cm thick fining upward sequences. Bdrk is ~3-4 m below base of this unit.

Legend

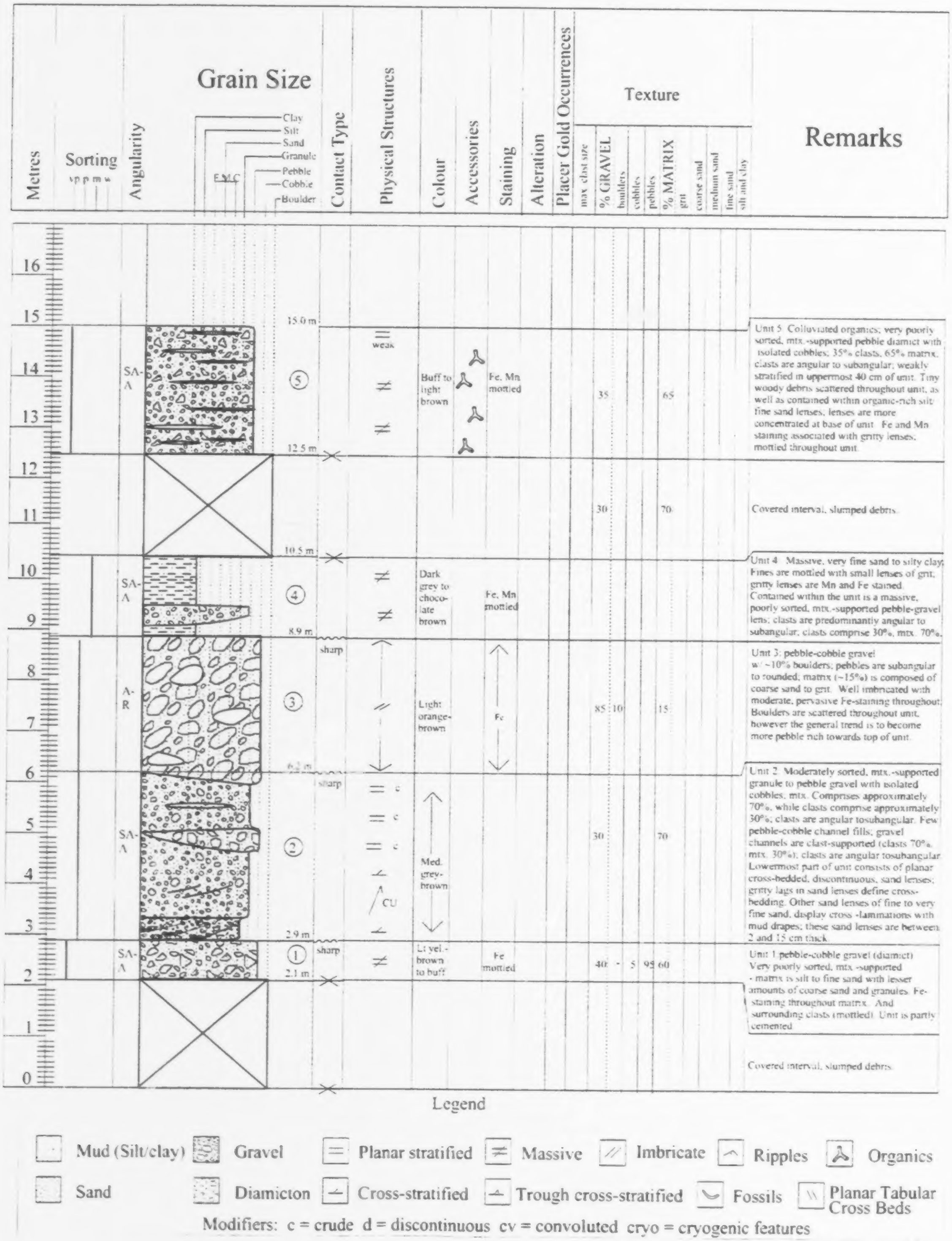
- ☐ Mud (Silt/clay)
- ▨ Gravel
- = Planar stratified
- ≠ Massive
- // Imbricate
- ⌒ Ripples
- ⅄ Organics
- ░ Sand
- ▨ Diamicton
- ∠ Cross-stratified
- ⌣ Trough cross-stratified
- ◡ Fossils
- \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 26 06 97 Section number: LW-97-04 Measured by: LW/TA Creek or River: Haggart Creek NTS: 106D4

Latitude: 64°00'43''N Longitude: 135°50'53''W Elevation: 2450 UTM: 458525E.7098525N

Orientation: 190° ⟷ 010° upstream Geomorphic landform: Glaciofluvial Complex/Colluvial Apron



Unit 5 Colluviated organics; very poorly sorted, mtx.-supported pebble diamict with isolated cobbles; 35% clasts, 65% matrix; clasts are angular to subangular; weakly stratified in uppermost 40 cm of unit. Tiny woody debris scattered throughout unit, as well as contained within organic-rich silt/fine sand lenses; lenses are more concentrated at base of unit. Fe and Mn staining associated with gritty lenses; mottled throughout unit.

Covered interval, slumped debris.

Unit 4 Massive, very fine sand to silty clay; Fines are mottled with small lenses of grit; gritty lenses are Mn and Fe stained. Contained within the unit is a massive, poorly sorted, mtx.-supported pebble-gravel lens; clasts are predominantly angular to subangular; clasts comprise 30%, mtx. 70%.

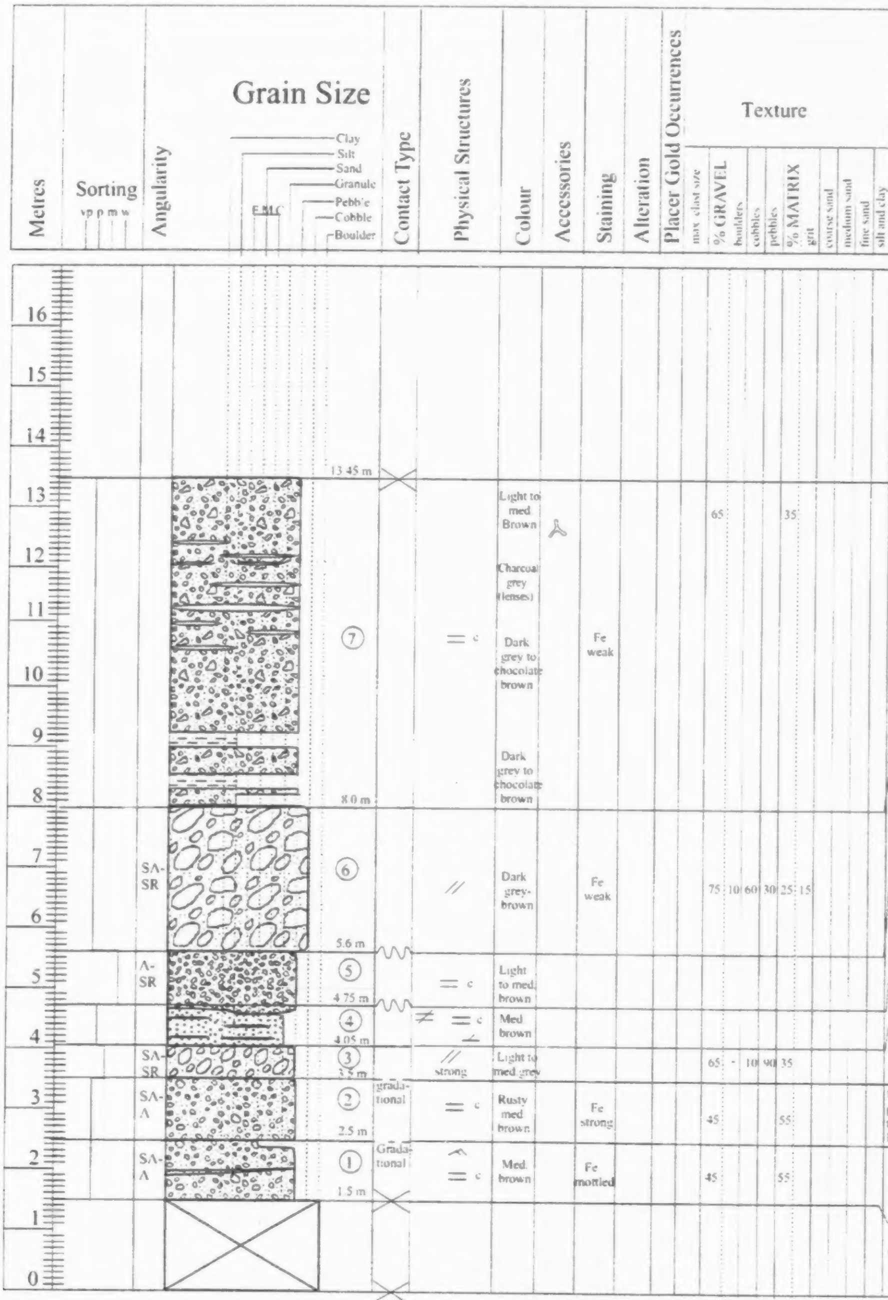
Unit 3: pebble-cobble gravel w/ ~10% boulders; pebbles are subangular to rounded; matrix (~15%) is composed of coarse sand to grit. Well imbricated with moderate, pervasive Fe-staining throughout; Boulders are scattered throughout unit, however the general trend is to become more pebble rich towards top of unit.

Unit 2 Moderately sorted, mtx.-supported granule to pebble gravel with isolated cobbles; mtx. Comprises approximately 70%, while clasts comprise approximately 30%; clasts are angular tosubangular. Few pebble-cobble channel fills; gravel channels are clast-supported (clasts 70%, mtx. 30%); clasts are angular tosubangular. Lowermost part of unit consists of planar cross-bedded, discontinuous, sand lenses; gritty lags in sand lenses define cross-bedding. Other sand lenses of fine to very fine sand, display cross-laminations with mud drapes; these sand lenses are between 2 and 15 cm thick.

Unit 1 pebble-cobble gravel (diamict) Very poorly sorted, mtx.-supported - matrix is silt to fine sand with lesser amounts of coarse sand and granules. Fe-staining throughout matrix. And surrounding clasts (mottled). Unit is partly cemented.

Covered interval, slumped debris.

Date: 02/07/97 Section number: LW-97-05 Measured by: LW, LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°00'42"N Longitude: 135°50'53"W Elevation: 2450 ft. UTM: 458525E, 7098500N
Orientation: 192° ⟷ 012° upstream Geomorphic landform: Glaciofluvial Complex / Colluvial Apron



Remarks

Unit 7: Interbedded organic-rich silty clay with poorly sorted, matrix supported pebble gravel.
-Organic silt/clay-rich at base of unit and grades into massive colluvium towards top of unit. Silt/clay portions of unit are crudely stratified and organic-rich; woody debris scattered throughout, samples of wood for C14 dating were taken at approx. 8.5 m and 10.45 m; silt/clay portions may contain gritty lenses. Pebble gravel (colluvium) consists of 65% mtx. (fine sand to grit) and 35% clasts (angular pebbles), crudely stratified. Fe-staining is weak to moderate and is pervasive throughout unit. Colour varies from dark blue-grey in clay-rich zones, to dark grey to chocolate brown in organic-rich zones, to light to medium brown in colluvial-rich zones.

Unit 6: Poorly sorted, clast-supported, cobble-boulder gravel; clasts are subangular to subrounded. Matrix (25%) is medium to coarse sand with approximately 15% grit; clasts (75%) are pebbles (30%), cobbles (60%) and boulders (10%). Fe-staining is weak and pervasive throughout unit. Imbrication is strong throughout unit.

Unit 5: Well sorted granule to pebble gravel; first 30 cm is granule with 10-15% med. sand, this grades into a matrix supported pebble gravel; mtx. (40%) is med. to coarse sand; clasts (60%) are angular to subrounded pebbles. Well stratified at base of unit and grades to crudely stratified.

Unit 4: Med. sand to granule with several fine sand to silty lenses (2-5 cm thick); weak x-stratification defined by gritty lenses. Top 15-20 cm is massive silty clay.

Unit 3: Mod. sorted, clast-supp., Pebble-cobble gravel; mtx. is med. sand to grit. Unit isn't laterally continuous; may be channel fill.

Unit 2: Poorly sorted, mtx.-supported pebble gravel with isolated cobbles. Similar to unit #1, however, coarser grained, lacking in sand lenses & heavily Fe-stained.

Unit 1: Poorly sorted, mtx.-supported, granule to pebble gravel, mtx. is med. to coarse sand. Med. to fine sand lenses are 3-10 cm thick and contain ripple marks with mud drapes.

Covered interval, slumped debris.

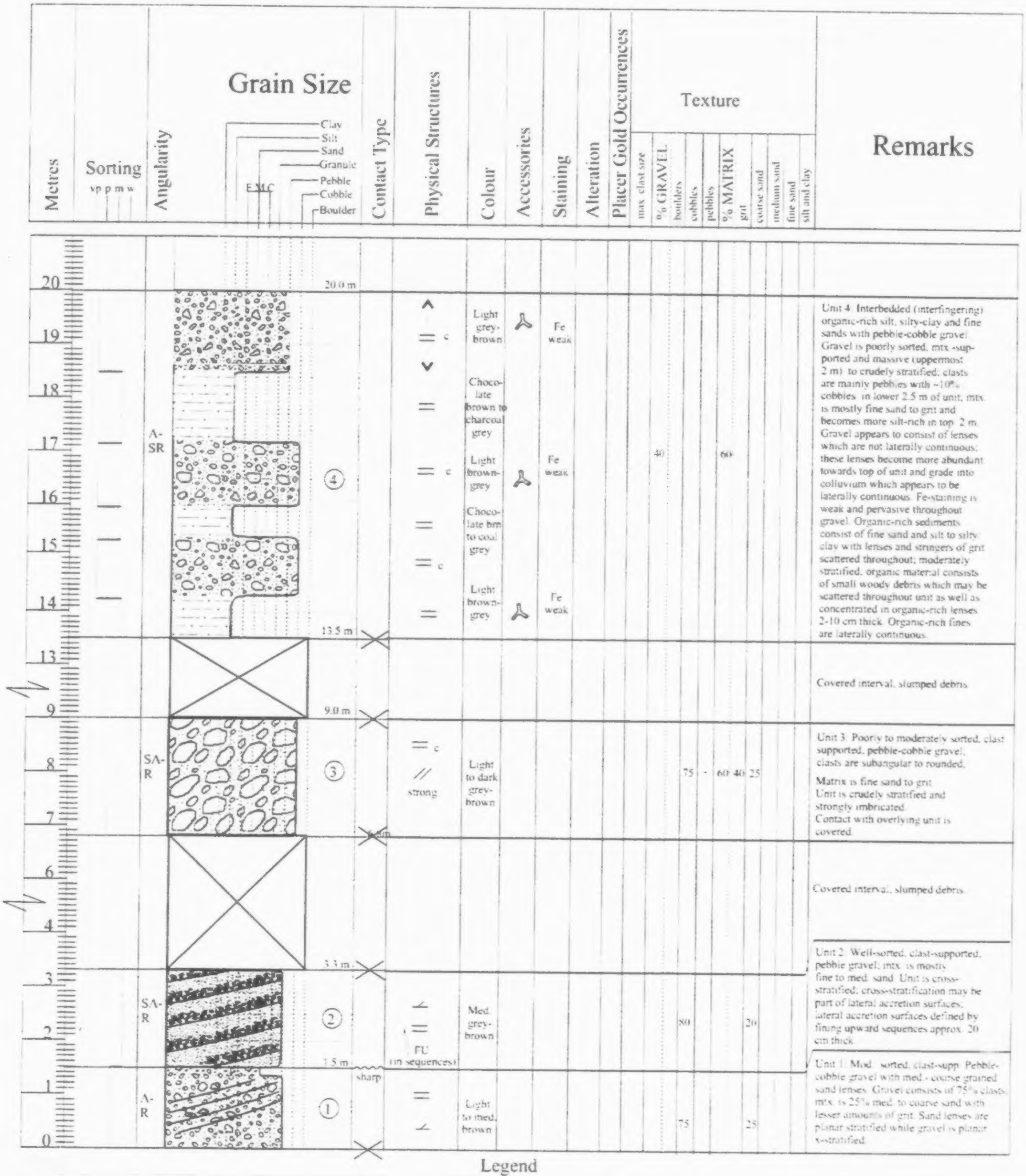
Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌃ Ripples ⅄ Organics

▨ Sand ▨ Diamicton ⊥ Cross-stratified ⊥ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 11 07 97 Section number: LW-97-06 Measured by: LW, LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°00'49"N Longitude: 135°50'53"W Elevation: 2480 ft. UTM: 458525E, 7098725N
Orientation: 088° ⟷ 268° upstream Geomorphic landform: Alluvial Fan / Glaciofluvial Complex / Colluvial Apron



Unit 4. Interbedded (interfingering) organic-rich silt, silty-clay and fine sands with pebble-cobble gravel. Gravel is poorly sorted, mtx -supported and massive (uppermost 2 m) to crudely stratified, clasts are mainly pebbles with ~10% cobbles in lower 2.5 m of unit; mtx is mostly fine sand to grit and becomes more silt-rich in top 2 m. Gravel appears to consist of lenses which are not laterally continuous; these lenses become more abundant towards top of unit and grade into colluvium which appears to be laterally continuous. Fe-staining is weak and pervasive throughout gravel. Organic-rich sediments consist of fine sand and silt to silty clay with lenses and stringers of grit scattered throughout; moderately stratified, organic material consists of small woody debris which may be scattered throughout unit as well as concentrated in organic-rich lenses 2-10 cm thick. Organic-rich fines are laterally continuous.

Covered interval, slumped debris

Unit 3: Poorly to moderately sorted, clast supported, pebble-cobble gravel, clasts are subangular to rounded.

Matrix is fine sand to grit.
Unit is crudely stratified and strongly imbricated.
Contact with overlying unit is covered.

Covered interval, slumped debris.

Unit 2: Well-sorted, clast-supported, pebble gravel; mtx. is mostly fine to med. sand. Unit is cross-stratified; cross-stratification may be part of lateral accretion surfaces; lateral accretion surfaces defined by fining upward sequences approx. 20 cm thick.

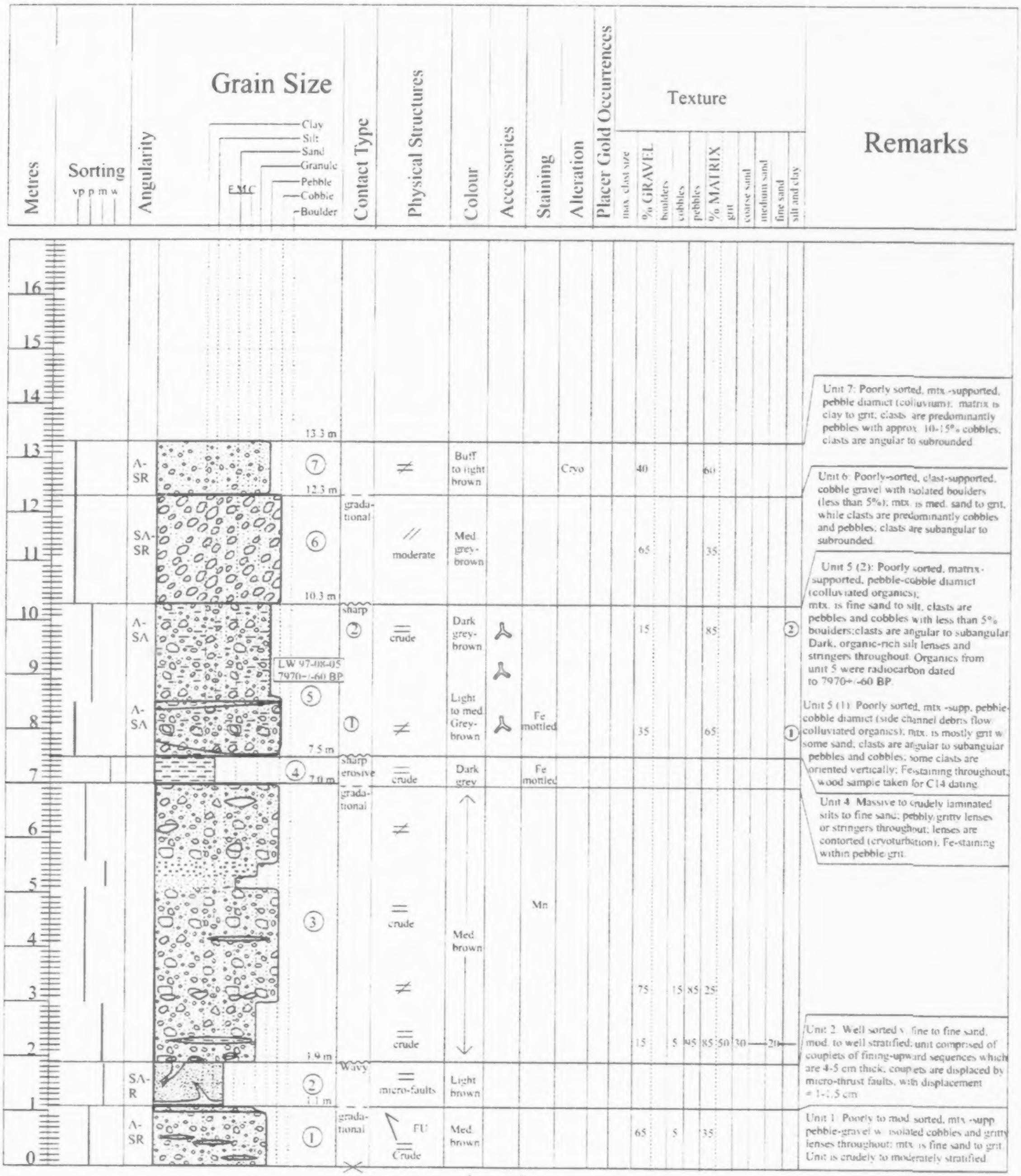
Unit 1: Mod. sorted, clast-supp. Pebble-cobble gravel with med.- coarse grained sand lenses. Gravel consists of 75% clasts, mtx. is 25% med. to coarse sand with lesser amounts of grit. Sand lenses are planar stratified while gravel is planar x-stratified.

Legend

Mud (Silt/clay)	Gravel	Planar stratified	Massive	Imbricate	Ripples	Organics
Sand	Diamicton	Cross-stratified	Trough cross-stratified	Fossils	Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 14/07/97 Section number: LW-97-08 Measured by: LW/JB Creek or River: Haggart Creek NTS: ______
Latitude: 64 00'57''N Longitude: 135 50'53''W Elevation: ______ UTM: 458525E,7098950N
Orientation: 250 ⟷ 070 Geomorphic landform: Alluvial Fan/Colluvial Apron



Unit 7: Poorly sorted, mtx.-supported, pebble diamict (colluvium); matrix is clay to grit; clasts are predominantly pebbles with approx. 10-15% cobbles; clasts are angular to subrounded.

Unit 6: Poorly-sorted, clast-supported, cobble gravel with isolated boulders (less than 5%); mtx. is med. sand to grit, while clasts are predominantly cobbles and pebbles; clasts are subangular to subrounded.

Unit 5 (2): Poorly sorted, matrix-supported, pebble-cobble diamict (colluviated organics); mtx. is fine sand to silt, clasts are pebbles and cobbles with less than 5% boulders; clasts are angular to subangular. Dark, organic-rich silt lenses and stringers throughout. Organics from unit 5 were radiocarbon dated to 7970+/-60 BP.

Unit 5 (1): Poorly sorted, mtx.-supp. pebble-cobble diamict (side channel debris flow colluviated organics); mtx. is mostly grit w/ some sand; clasts are angular to subangular pebbles and cobbles; some clasts are oriented vertically; Fe-staining throughout; wood sample taken for C14 dating.

Unit 4: Massive to crudely laminated silts to fine sand; pebbly/gritty lenses or stringers throughout; lenses are contorted (cryoturbation); Fe-staining within pebble grit.

Unit 2: Well sorted v. fine to fine sand, mod. to well stratified; unit comprised of couplets of fining-upward sequences which are 4-5 cm thick; couplets are displaced by micro-thrust faults, with displacement = 1-1.5 cm.

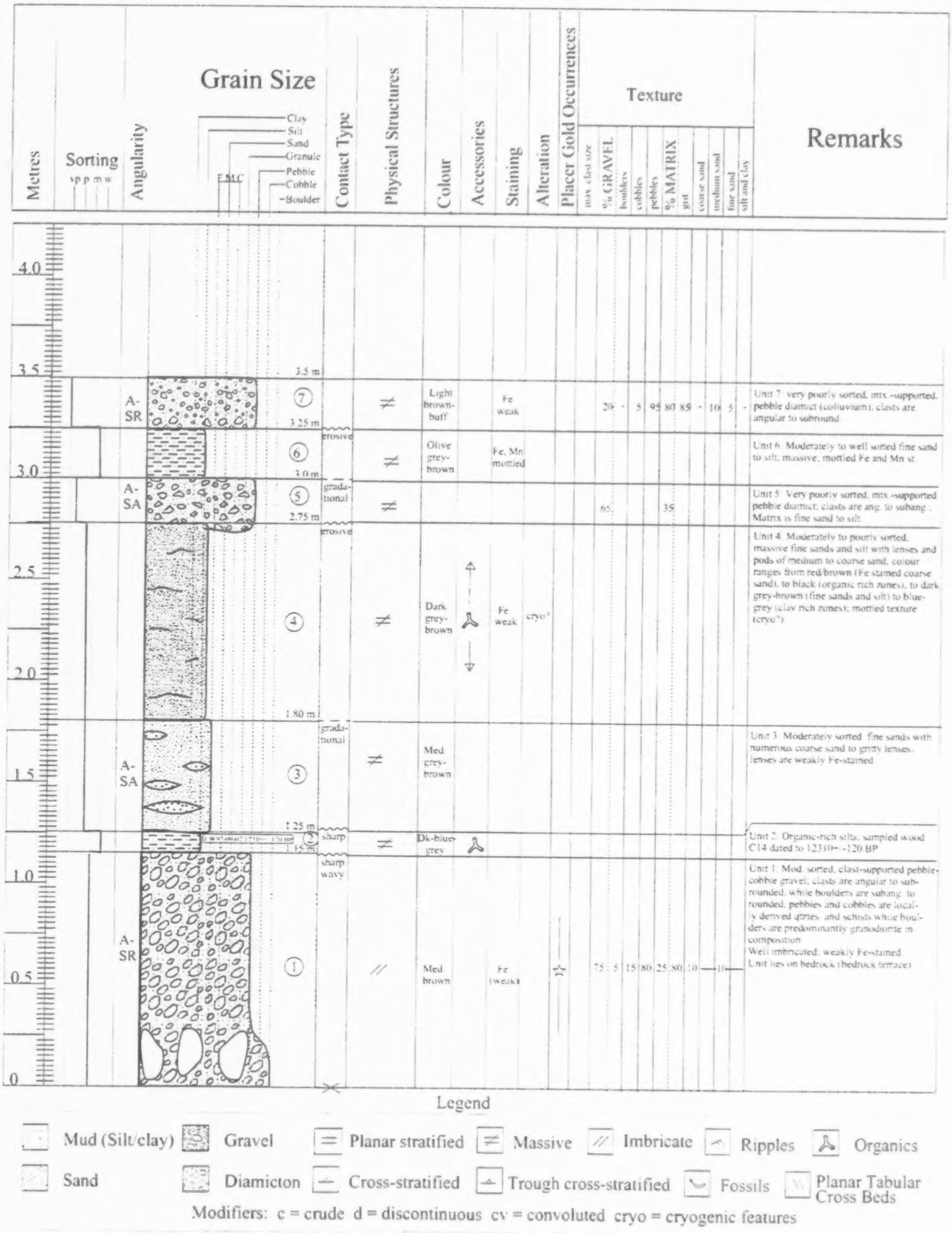
Unit 1: Poorly to mod. sorted, mtx.-supp. pebble-gravel w. isolated cobbles and gritty lenses throughout; mtx. is fine sand to grit. Unit is crudely to moderately stratified.

Legend

⬚	Mud (Silt/clay)	▨	Gravel	=	Planar stratified	≠	Massive	//	Imbricate	⌃	Ripples	⅄	Organics
⬚	Sand	▨	Diamicton	∠	Cross-stratified	⌃	Trough cross-stratified	◡	Fossils	\\	Planar Tabular Cross Beds		

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 08/08/97 Section number: LW-97-09 Measured by: LW/LM Creek or River: Gill Gulch NTS: 106D4
Latitude 64°01'41''N Longitude: 135°51'15''W Elevation: 2440 UTM: 458200E.7100275N
Orientation: 218° ⟷ 038° upstream Geomorphic landform: Alluvial Gravel/Alluvial Fan



Unit 7: very poorly sorted, mtx.-supported, pebble diamict (colluvium); clasts are angular to subround.

Unit 6: Moderately to well sorted fine sand to silt; massive, mottled Fe and Mn st.

Unit 5: Very poorly sorted, mtx.-supported pebble diamict; clasts are ang. to subang.; Matrix is fine sand to silt.

Unit 4: Moderately to poorly sorted, massive fine sands and silt with lenses and pods of medium to coarse sand, colour ranges from red/brown (Fe stained coarse sand), to black (organic rich zones), to dark grey-brown (fine sands and silt) to blue-grey (clay rich zones); mottled texture (cryo?)

Unit 3: Moderately sorted fine sands with numerous coarse sand to gritty lenses, lenses are weakly Fe-stained

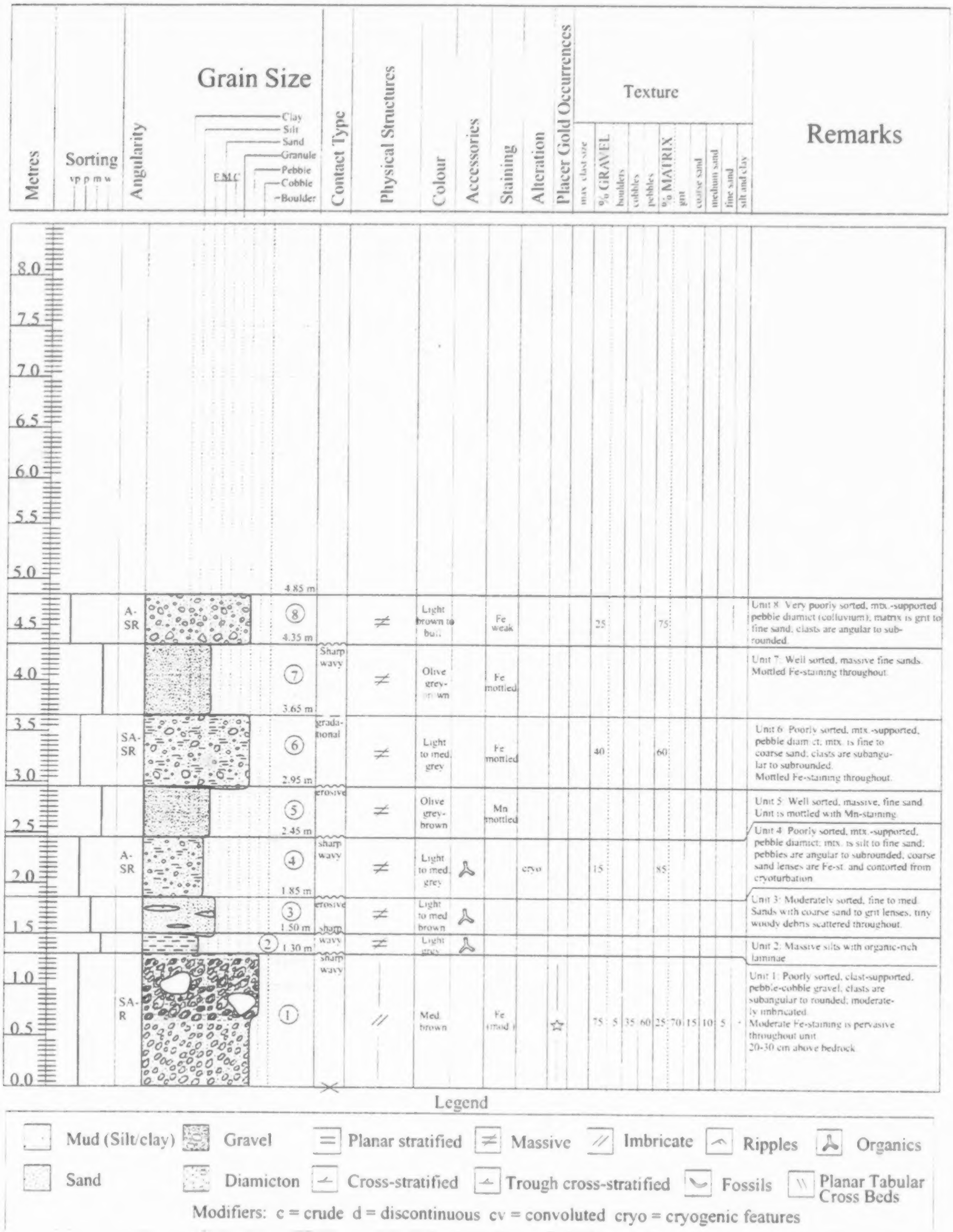
Unit 2: Organic-rich silts; sampled wood C14 dated to 12310+/-120 BP

Unit 1: Mod. sorted, clast-supported pebble-cobble gravel; clasts are angular to subrounded, while boulders are subang. to rounded, pebbles and cobbles are locally derived qtzites and schists while boulders are predominantly granodiorite in composition
Well imbricated, weakly Fe-stained
Unit lies on bedrock (bedrock terrace)

Date: 09/08/97 Section number: LW-97-10 Measured by: LW/LM Creek or River: Gill Gulch NTS: 106D4

Latitude: 64°01'41''N Longitude: 135°51'15''W Elevation: 2440 UTM: 458200E,7100275N

Orientation: 205° ⟷ 025° upstream Geomorphic landform: Alluvial Plain/Alluvial Fan



Unit 8: Very poorly sorted, mtx.-supported pebble diamict (colluvium); matrix is grit to fine sand; clasts are angular to subrounded.

Unit 7: Well sorted, massive fine sands. Mottled Fe-staining throughout.

Unit 6: Poorly sorted, mtx.-supported, pebble diamict; mtx. is fine to coarse sand; clasts are subangular to subrounded. Mottled Fe-staining throughout.

Unit 5: Well sorted, massive, fine sand. Unit is mottled with Mn-staining.

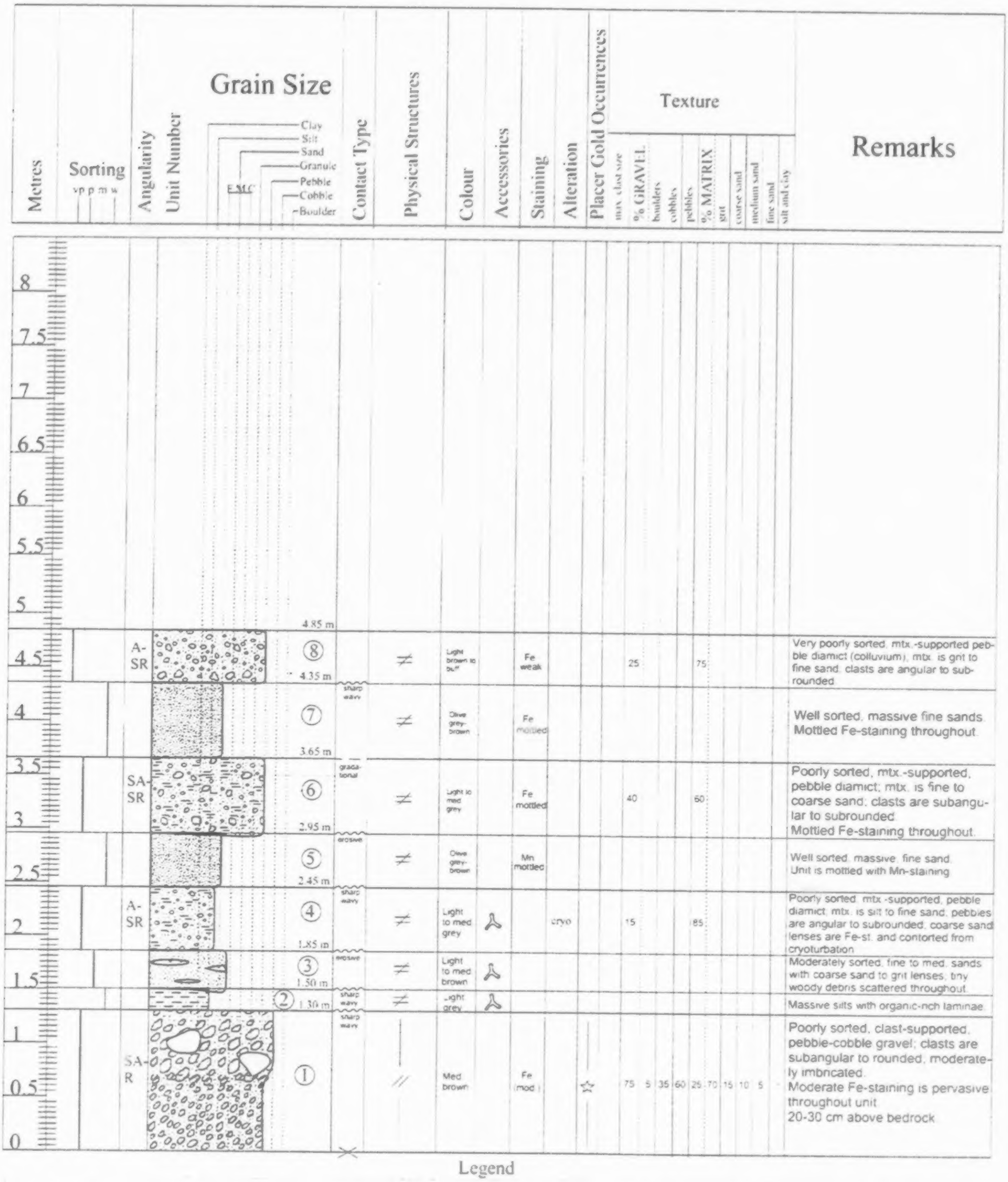
Unit 4: Poorly sorted, mtx.-supported, pebble diamict; mtx. is silt to fine sand; pebbles are angular to subrounded; coarse sand lenses are Fe-st. and contorted from cryoturbation.

Unit 3: Moderately sorted, fine to med. Sands with coarse sand to grit lenses, tiny woody debris scattered throughout.

Unit 2: Massive silts with organic-rich laminae.

Unit 1: Poorly sorted, clast-supported, pebble-cobble gravel; clasts are subangular to rounded; moderately imbricated. Moderate Fe-staining is pervasive throughout unit. 20-30 cm above bedrock.

Date: 09/08/97 Section number: LW-97-10 Measured by: LW/LM Creek or River: Gill Gulch NTS: 106D4
Latitude 64°01'41''N Longitude: 135°51'15''W Elevation: 2440 UTM: 458200E,7100275N
Orientation: 205° ⟷ 025° upstream Geomorphic landform: Alluvial Plain/Alluvial Fan



Unit Number	Top	Angularity	Contact Type	Physical Structures	Colour	Accessories	Staining	Alteration	Placer Gold Occurrences	max. clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay	Remarks
⑧	4.85 m	A-SR		≠	Light brown to buff		Fe weak				25				75						Very poorly sorted, mtx.-supported pebble diamict (colluvium), mtx. is grit to fine sand, clasts are angular to subrounded
⑦	4.35 m		sharp wavy	≠	Olive grey-brown		Fe mottled														Well sorted, massive fine sands. Mottled Fe-staining throughout.
⑥	3.65 m	SA-SR	gradational	≠	Light to med grey		Fe mottled				40				60						Poorly sorted, mtx.-supported, pebble diamict; mtx. is fine to coarse sand; clasts are subangular to subrounded. Mottled Fe-staining throughout.
⑤	2.95 m		erosive	≠	Olive grey-brown		Mn mottled														Well sorted, massive, fine sand. Unit is mottled with Mn-staining
④	2.45 m	A-SR	sharp wavy	≠	Light to med grey	⅄		cryo			15				85						Poorly sorted, mtx.-supported, pebble diamict, mtx. is silt to fine sand, pebbles are angular to subrounded, coarse sand lenses are Fe-st. and contorted from cryoturbation
③	1.85 m		erosive	≠	Light to med brown	⅄															Moderately sorted, fine to med. sands with coarse sand to grit lenses, tiny woody debris scattered throughout
②	1.50 m		sharp wavy	≠	Light grey	⅄															Massive silts with organic-rich laminae
①	1.30 m	SA-R	sharp wavy	//	Med brown		Fe (mod.)		☆		75	5	35	60	25	70	15	10	5	-	Poorly sorted, clast-supported, pebble-cobble gravel; clasts are subangular to rounded, moderately imbricated. Moderate Fe-staining is pervasive throughout unit. 20-30 cm above bedrock

Legend

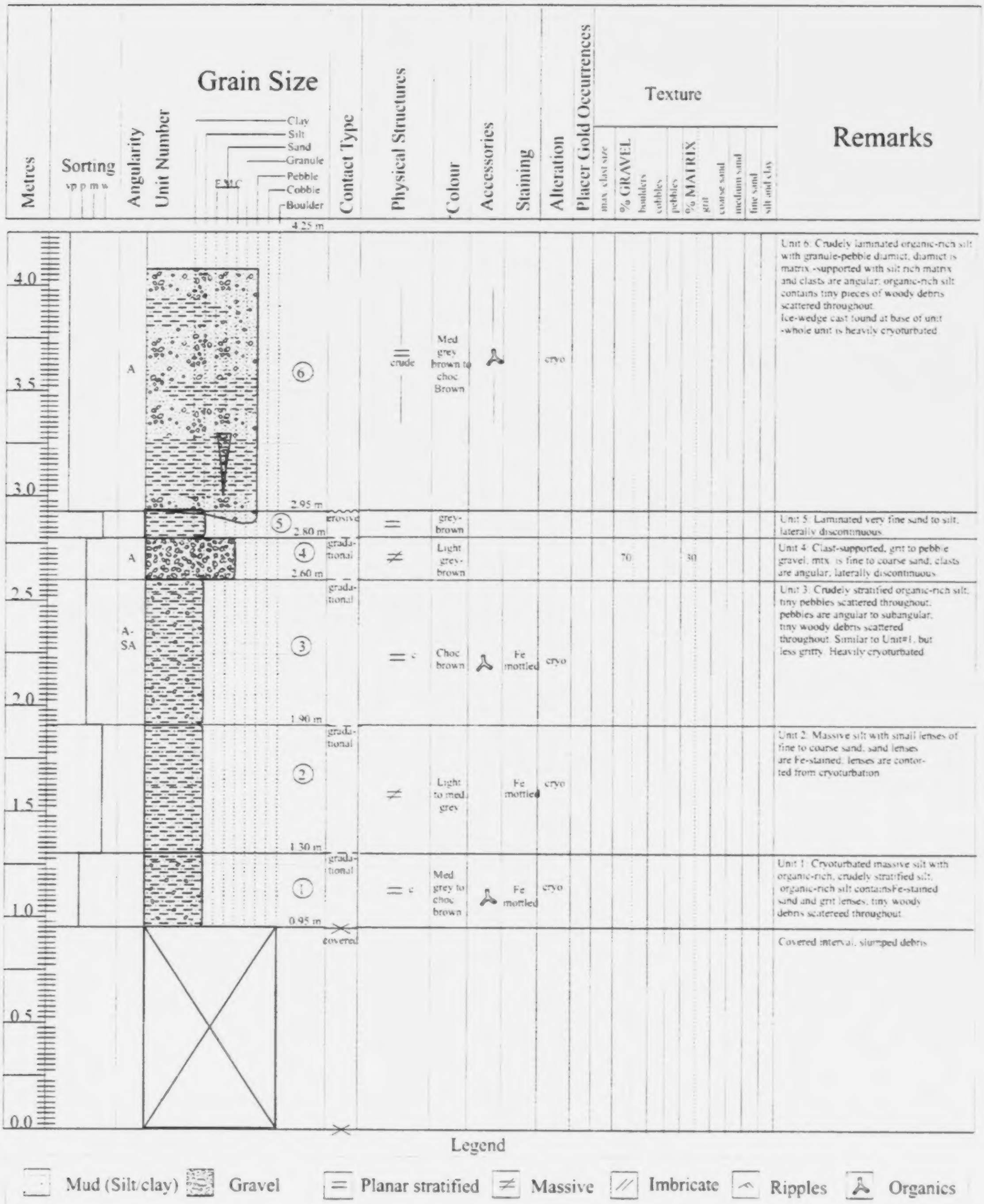
☐	Mud (Silt/clay)	▨	Gravel	=	Planar stratified	≠	Massive	//	Imbricate
☐	Sand	▨	Diamicton		Cross-stratified		Trough cross-stratified		Fossils
	Ripples	⅄	Organics		Planar Tabular Cross Beds				

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 14/08/97 Section number: LW-97-11 Measured by: LW/LM Creek or River: Gill Gulch NTS: 106D4

Latitude: 64°01'39''N Longitude: 135°51'15''W Elevation: 2445 UTM: 458200E,7100225N

Orientation: 170° ⟷ 350° upstream Geomorphic landform: Alluvial Fan



Unit 6: Crudely laminated organic-rich silt with granule-pebble diamict, diamict is matrix -supported with silt rich matrix and clasts are angular; organic-rich silt contains tiny pieces of woody debris scattered throughout.
Ice-wedge cast found at base of unit
-whole unit is heavily cryoturbated

Unit 5: Laminated very fine sand to silt, laterally discontinuous

Unit 4: Clast-supported, grit to pebble gravel, mtx. is fine to coarse sand, clasts are angular, laterally discontinuous

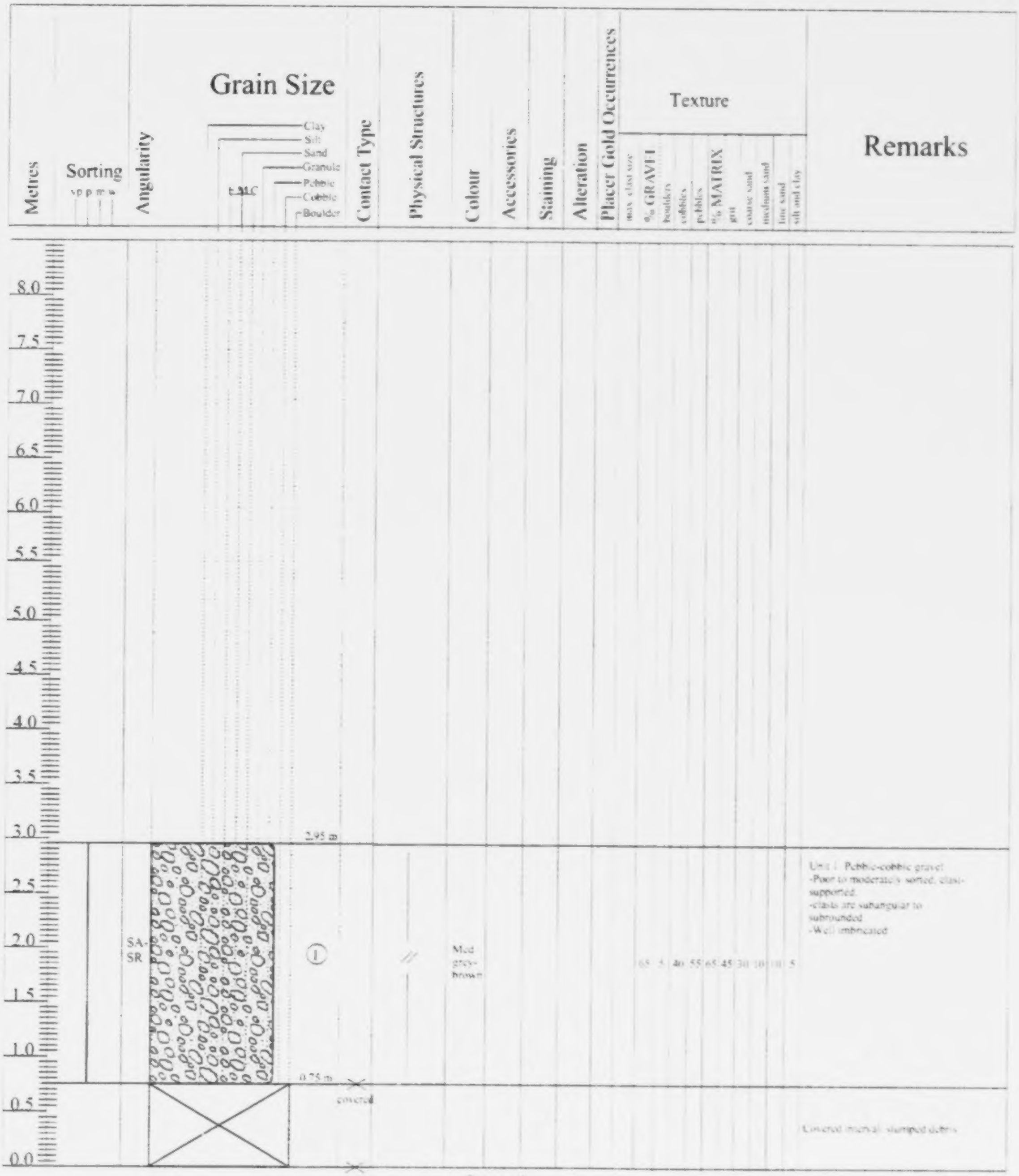
Unit 3: Crudely stratified organic-rich silt; tiny pebbles scattered throughout. pebbles are angular to subangular, tiny woody debris scattered throughout. Similar to Unit#1, but less gritty. Heavily cryoturbated

Unit 2: Massive silt with small lenses of fine to coarse sand, sand lenses are Fe-stained, lenses are contorted from cryoturbation

Unit 1: Cryoturbated massive silt with organic-rich, crudely stratified silt, organic-rich silt containsFe-stained sand and grit lenses, tiny woody debris scatereed throughout

Covered interval, slumped debris

Date: 14 08 97 Section number: LW-97-12 Measured by: LW/LM Creek or River: Gill Gulch NTS: 106D4
Latitude: 64°01'36''N Longitude: 135°51'12''W Elevation: 2420 ft UTM: 458225E,7100125N
Orientation: 160° ⟷ 340° upstream Geomorphic landform: Alluvial Plain



Unit 1: Pebble-cobble gravel
-Poor to moderately sorted, clast-supported.
-clasts are subangular to subrounded
-Well imbricated

Covered interval: slumped debris

Legend

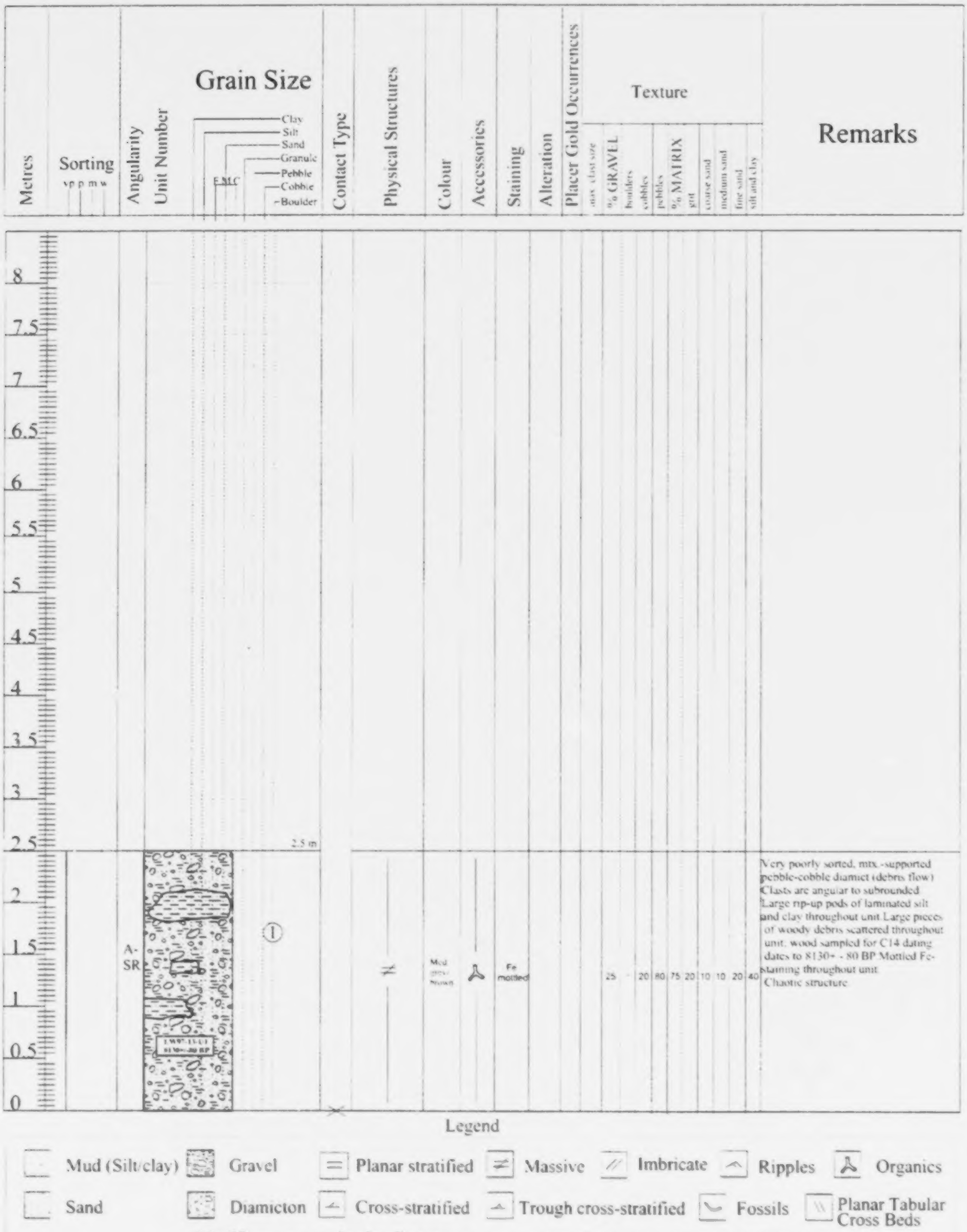
Mud (Silt/clay) Gravel Planar stratified Massive Imbricate Ripples Organics
Sand Diamicton Cross-stratified Trough cross-stratified Fossils Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 15/08/97 Section number: LW-97-13 Measured by: LW LM Creek or River: Gill Gulch NTS: 106D4

Latitude: 64°01'32''N Longitude: 135°51'07''W Elevation: 2410 UTM: 458325E,7100050N

Orientation: 190° ⟷ 010° upstream Geomorphic landform: Debris Flow

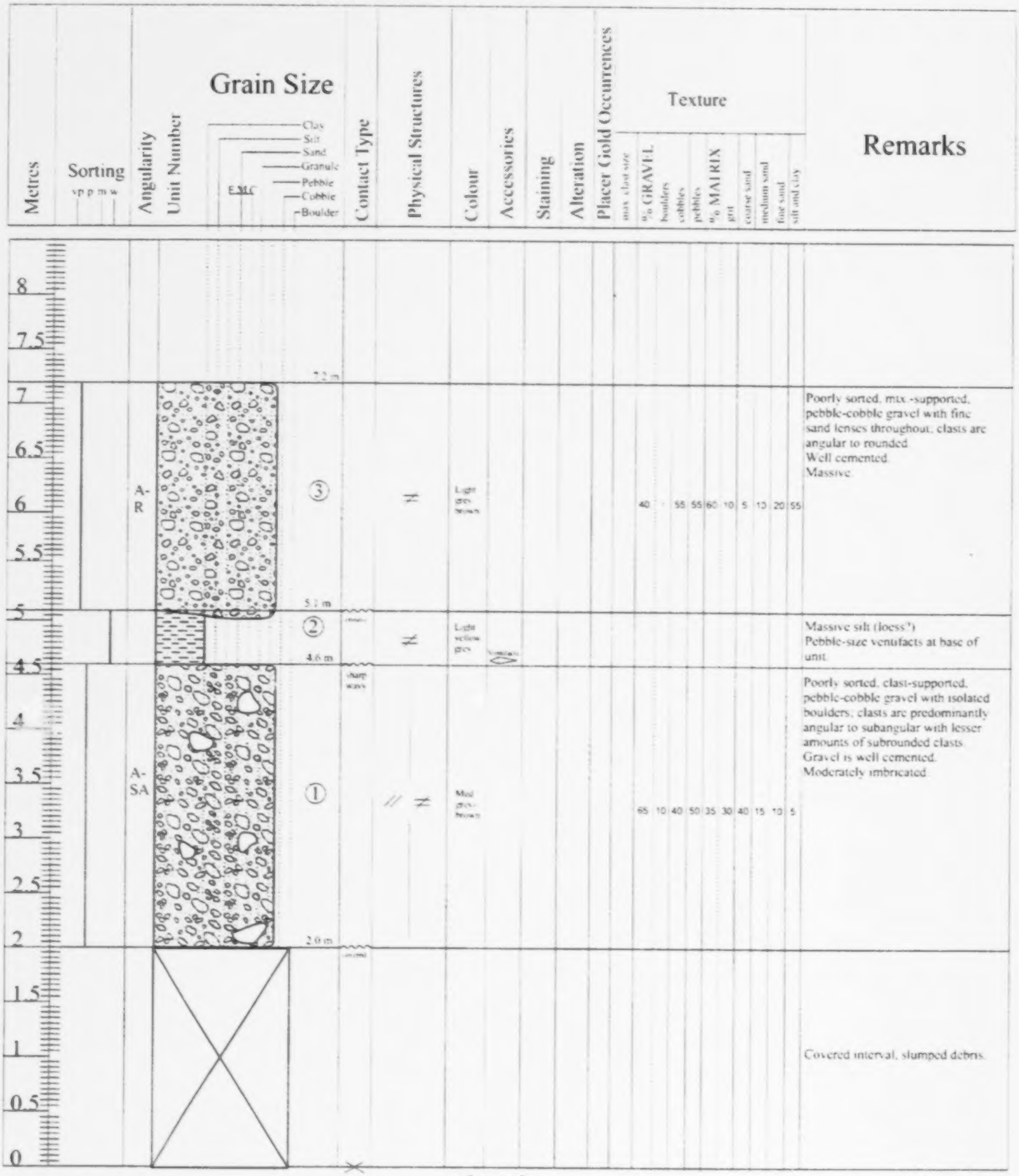


Very poorly sorted, mtx.-supported pebble-cobble diamict (debris flow) Clasts are angular to subrounded Large rip-up pods of laminated silt and clay throughout unit Large pieces of woody debris scattered throughout unit. wood sampled for C14 dating dates to 8130+ - 80 BP Mottled Fe-staining throughout unit Chaotic structure

Date: 19 08 97 Section number: LW-97-14 Measured by: LW/LM Creek or River: Gill Gulch NTS: 106D4

Latitude: 64°01'38''N Longitude: 135°51'11''W Elevation: 2415 UTM: 458250E,7100175N

Orientation: 158° ⟷ 338° upstream Geomorphic landform: Periglacial Fan



Poorly sorted, mtx-supported, pebble-cobble gravel with fine sand lenses throughout; clasts are angular to rounded.
Well cemented.
Massive.

Massive silt (loess?)
Pebble-size ventifacts at base of unit.

Poorly sorted, clast-supported, pebble-cobble gravel with isolated boulders; clasts are predominantly angular to subangular with lesser amounts of subrounded clasts.
Gravel is well cemented.
Moderately imbricated.

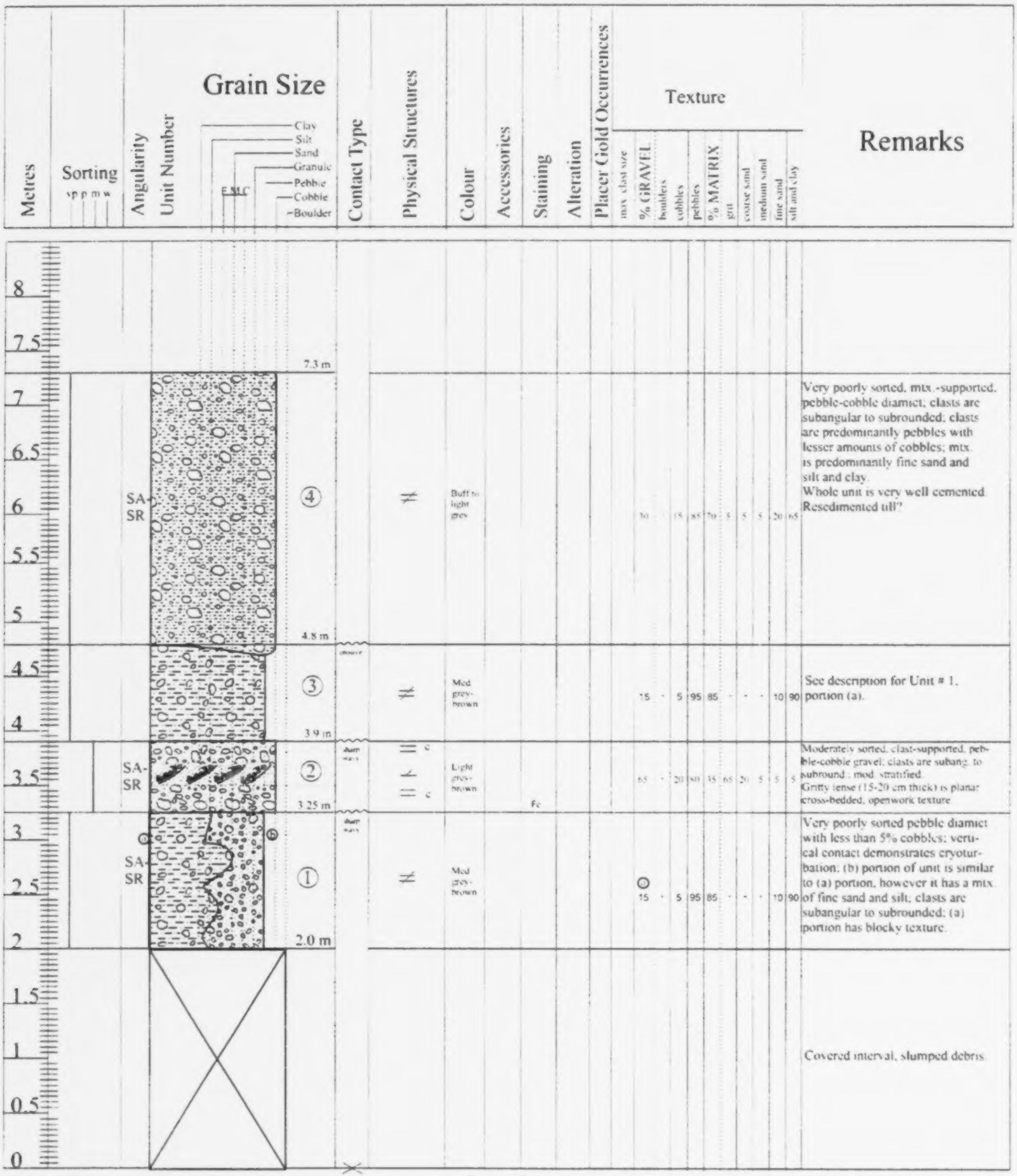
Covered interval, slumped debris.

Legend

☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	Organics
☐ Sand	▨ Diamicton	Cross-stratified	Trough cross-stratified	Fossils	Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 20/08/97 Section number: LW-97-15 Measured by: LW/LM Creek or River: Haggart Creek NTS: 106D4
Latitude 64°01'01''N Longitude: 135°50'53''W Elevation: 2520 UTM: 458525E,7099100N
Orientation: 278° ⟷ 098° Geomorphic landform: Alluvial Fan/Colluvial Apron



Very poorly sorted, mtx.-supported, pebble-cobble diamict; clasts are subangular to subrounded; clasts are predominantly pebbles with lesser amounts of cobbles; mtx. is predominantly fine sand and silt and clay.
Whole unit is very well cemented.
Resedimented till?

See description for Unit # 1, portion (a).

Moderately sorted, clast-supported, pebble-cobble gravel; clasts are subang. to subround.; mod. stratified.
Gritty lense (15-20 cm thick) is planar cross-bedded, openwork texture

Very poorly sorted pebble diamict with less than 5% cobbles; vertical contact demonstrates cryoturbation; (b) portion of unit is similar to (a) portion, however it has a mtx. of fine sand and silt; clasts are subangular to subrounded; (a) portion has blocky texture.

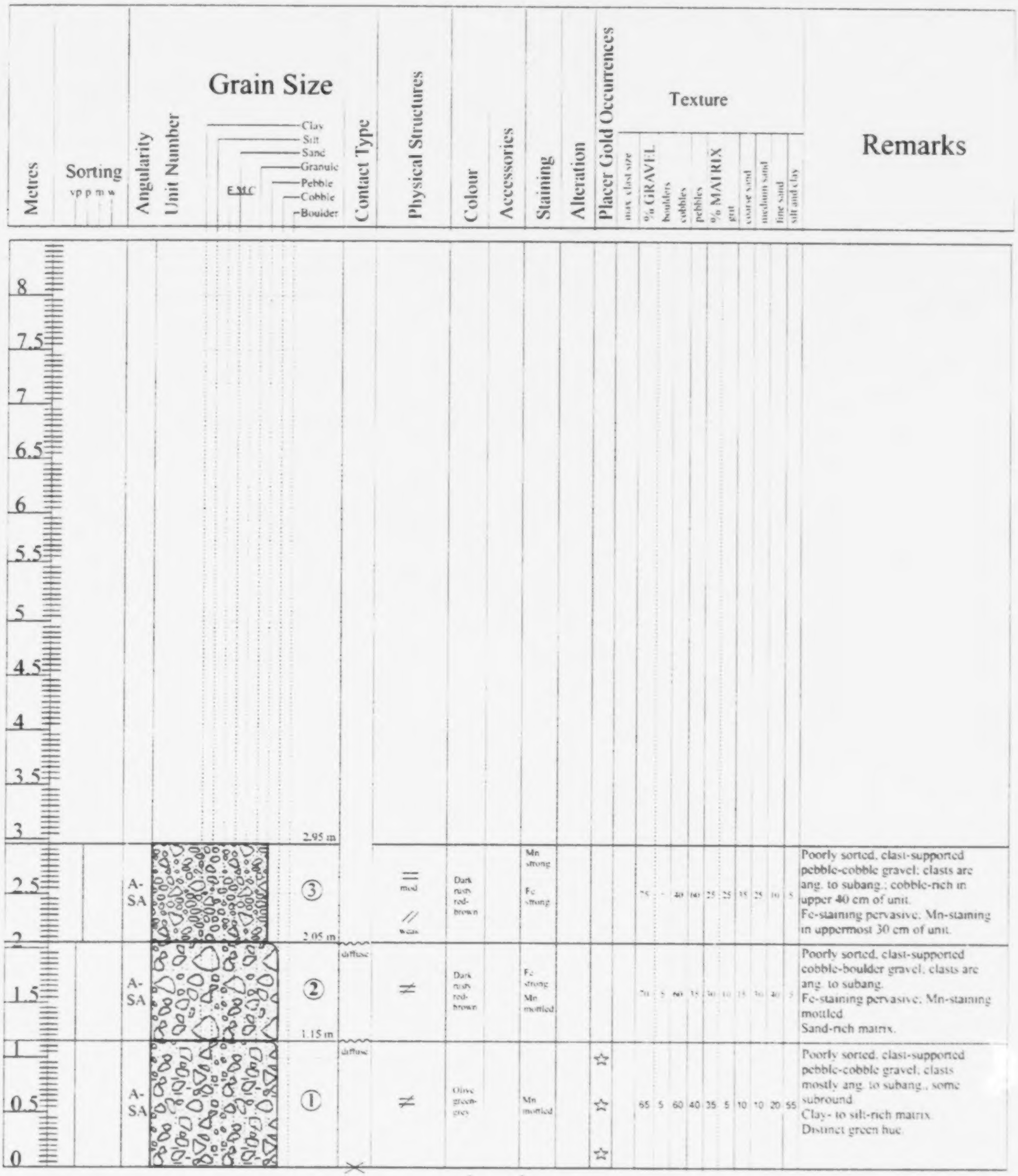
Covered interval, slumped debris.

Legend

☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics
☐ Sand ▨ Diamicton ⊥ Cross-stratified ⊥ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 21/08/97 Section number: LW-97-16 Measured by: LW/LM Creek or River: Fisher Gulch NTS: 106D4
Latitude 64°02'24''N Longitude: 135°52'04''W Elevation: 2800 UTM: 457525E,7101625N
Orientation: 144° ⟷ 324° upstream Geomorphic landform: Gulch gravel



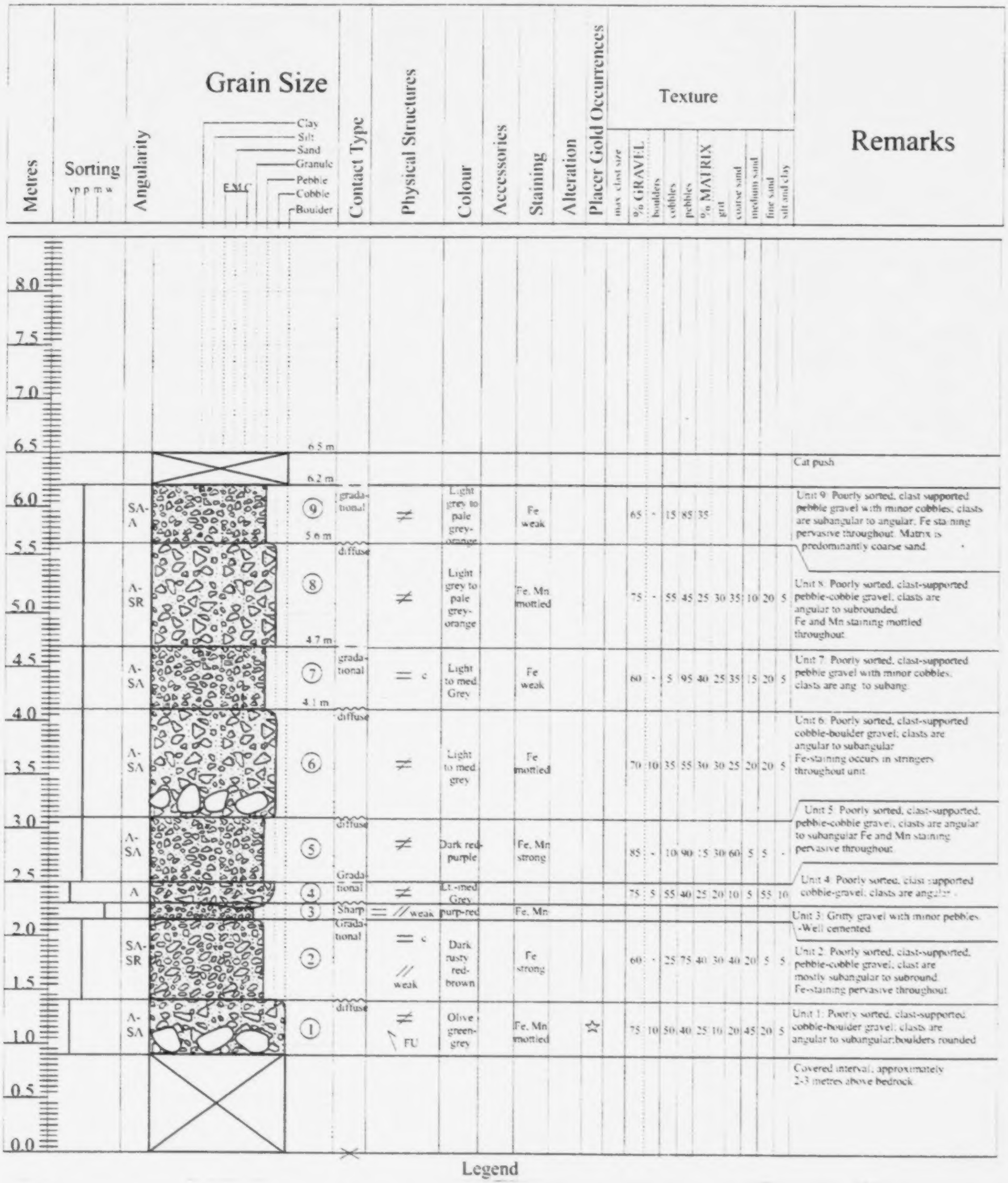
Unit Number	Top	Angularity	Contact Type	Physical Structures	Colour	Staining	Placer Gold Occurrences	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay	Remarks
③	2.95 m	A-SA		= mod // weak	Dark rusty red-brown	Mn strong Fe strong		75	-	40	60	25	25	35	25	10	5	Poorly sorted, clast-supported pebble-cobble gravel; clasts are ang. to subang.; cobble-rich in upper 40 cm of unit. Fe-staining pervasive; Mn-staining in uppermost 30 cm of unit.
②	2.05 m	A-SA	diffuse	≠	Dark rusty red-brown	Fe strong Mn mottled		70	5	60	35	30	10	15	30	40	5	Poorly sorted, clast-supported cobble-boulder gravel; clasts are ang. to subang. Fe-staining pervasive; Mn-staining mottled. Sand-rich matrix.
①	1.15 m	A-SA	diffuse	≠	Olive green-grey	Mn mottled	☆ ☆ ☆	65	5	60	40	35	5	10	10	20	55	Poorly sorted, clast-supported pebble-cobble gravel; clasts mostly ang. to subang., some subround. Clay- to silt-rich matrix. Distinct green hue.

Legend

Mud (Silt/clay) · Gravel · = Planar stratified · ≠ Massive · // Imbricate · Ripples · Organics
Sand · Diamicton · Cross-stratified · Trough cross-stratified · Fossils · Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 21/08/97 Section number: LW-97-17 Measured by: LW/LM Creek or River: Fisher Gulch NTS: 106D4
Latitude: 64°02'23"N Longitude: 135°52'09"W Elevation: 2825 UTM: 457450E.7101600N
Orientation: 061° ↔ 341° upstream Geomorphic landform: Gulch gravel



Unit	Angularity	Contact Type	Physical Structures	Colour	Staining	Placer Gold Occurrences	max clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay	Remarks
																		Cat push
9	SA-A	gradational	≠	Light grey to pale grey-orange	Fe weak		65		-	15	85	35						Unit 9: Poorly sorted, clast supported pebble gravel with minor cobbles; clasts are subangular to angular. Fe staining pervasive throughout. Matrix is predominantly coarse sand.
8	A-SR	diffuse	≠	Light grey to pale grey-orange	Fe, Mn mottled		75		-	55	45	25	30	35	10	20	5	Unit 8: Poorly sorted, clast-supported pebble-cobble gravel; clasts are angular to subrounded Fe and Mn staining mottled throughout
7	A-SA	gradational	= c	Light to med Grey	Fe weak		60		-	5	95	40	25	35	15	20	5	Unit 7: Poorly sorted, clast-supported pebble gravel with minor cobbles, clasts are ang. to subang.
6	A-SA	diffuse	≠	Light to med grey	Fe mottled		70		10	35	55	30	30	25	20	20	5	Unit 6: Poorly sorted, clast-supported cobble-boulder gravel; clasts are angular to subangular Fe-staining occurs in stringers throughout unit
5	A-SA	diffuse	≠	Dark red-purple	Fe, Mn strong		85		-	10	90	15	30	60	5	5	-	Unit 5: Poorly sorted, clast-supported, pebble-cobble gravel, clasts are angular to subangular Fe and Mn staining pervasive throughout
4	A	Gradational	≠	Lt.-med Grey			75		5	55	40	25	20	10	5	55	10	Unit 4: Poorly sorted, clast supported cobble-gravel; clasts are angular.
3		Sharp	= // weak	purp-red	Fe, Mn													Unit 3: Gritty gravel with minor pebbles -Well cemented
2	SA-SR	Gradational	= c // weak	Dark rusty red-brown	Fe strong		60		-	25	75	40	30	40	20	5	5	Unit 2: Poorly sorted, clast-supported, pebble-cobble gravel; clast are mostly subangular to subround Fe-staining pervasive throughout
1	A-SA	diffuse	≠ FU	Olive green-grey	Fe, Mn mottled	☆	75		10	50	40	25	10	20	45	20	5	Unit 1: Poorly sorted, clast-supported cobble-boulder gravel; clasts are angular to subangular; boulders rounded
																		Covered interval; approximately 2-3 metres above bedrock

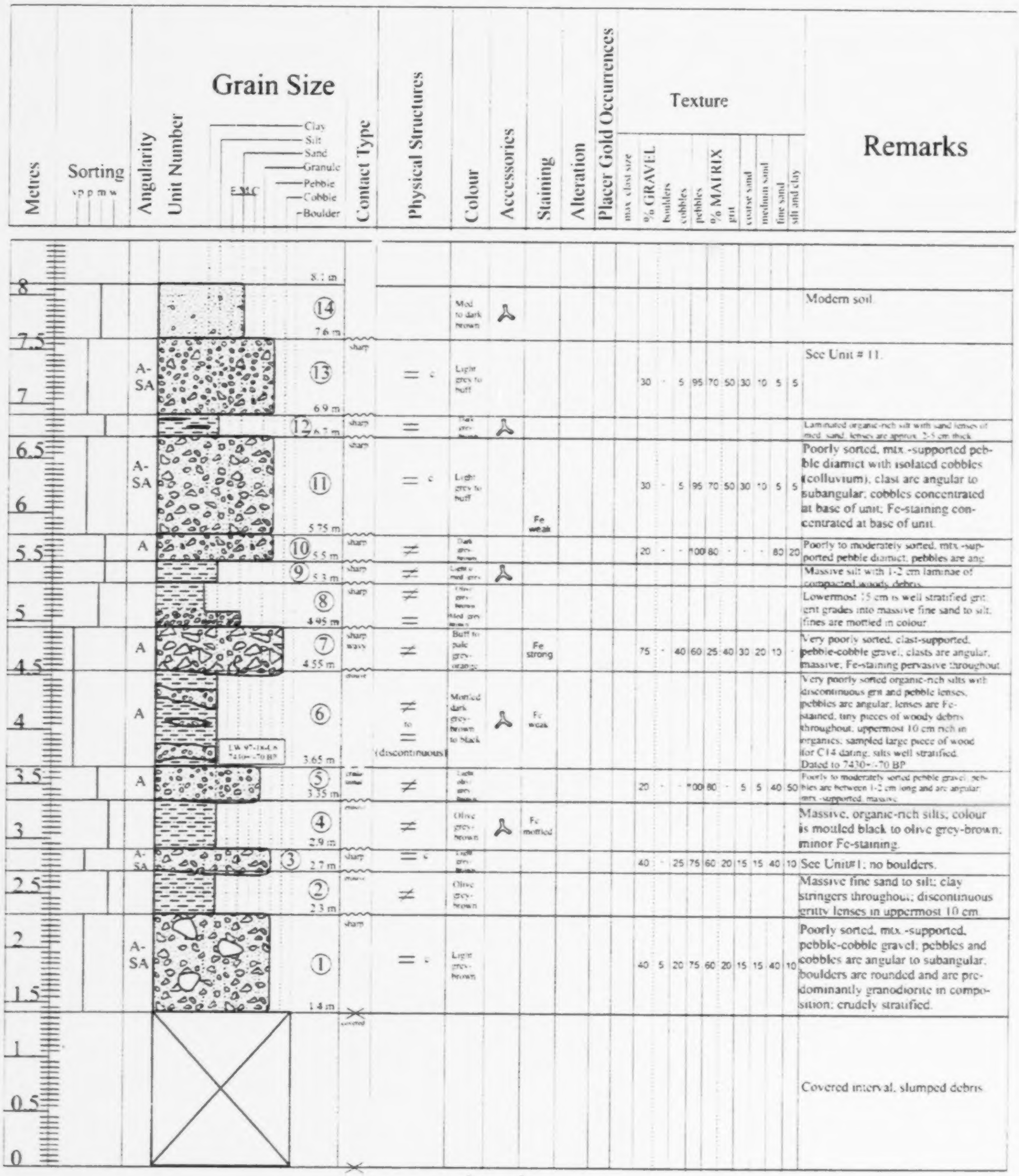
Legend

☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples
⛬ Sand	▨ Diamicton	Cross-stratified	Trough cross-stratified	Fossils	Planar Tabular Cross Beds

Organics

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 22/08/97 Section number: LW-97-18 Measured by: LW/LM Creek or River: Dublin Gulch NTS: 106D4
Latitude 64°02'08''N Longitude: 135°49'33''W Elevation: 2890 UTM: 459600E,7101150N
Orientation: 052° ⟷ 232° upstream Geomorphic landform: Alluvial Plain/Colluvial Apron



Unit Number	Top	Angularity	Contact Type	Physical Structures	Colour	Accessories	Staining	max clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay	Remarks
⑭	7.6 m				Med to dark brown	⅄													Modern soil.
⑬	6.9 m	A-SA	sharp	= c	Light grey to buff				30	-	5	95	70	50	30	10	5	5	See Unit # 11.
⑫	6.7 m		sharp	=	Dark grey-brown	⅄													Laminated organic-rich silt with sand lenses of med. sand; lenses are approx. 2-5 cm thick.
⑪	5.75 m	A-SA	sharp	= c	Light grey to buff		Fe weak		30	-	5	95	70	50	30	10	5	5	Poorly sorted, mtx.-supported pebble diamict with isolated cobbles (colluvium); clast are angular to subangular; cobbles concentrated at base of unit; Fe-staining concentrated at base of unit.
⑩	5.5 m	A	sharp	≠	Dark grey-brown				20	-	-	100	80	-	-	-	80	20	Poorly to moderately sorted, mtx.-supported pebble diamict; pebbles are ang
⑨	5.3 m		sharp	≠	Light to med. grey	⅄													Massive silt with 1-2 cm laminae of compacted woody debris.
⑧	4.95 m		sharp	≠ =	Olive grey-brown ttled grey-brown														Lowermost 15 cm is well stratified grit; grit grades into massive fine sand to silt; fines are mottled in colour.
⑦	4.55 m	A	sharp wavy	≠	Buff to pale grey-orange		Fe strong		75	-	40	60	25	40	30	20	10	-	Very poorly sorted, clast-supported, pebble-cobble gravel; clasts are angular, massive; Fe-staining pervasive throughout.
⑥	3.65 m	A	[illegible]	≠ to = (discontinuous)	Mottled dark grey-brown to black	⅄	Fe weak												Very poorly sorted organic-rich silts with discontinuous grit and pebble lenses; pebbles are angular; lenses are Fe-stained; tiny pieces of woody debris throughout; uppermost 10 cm rich in organics; sampled large piece of wood for C14 dating; silts well stratified. Dated to 7430+/-70 BP
⑤	3.35 m	A	[illegible]	≠	Light olive grey-brown				20	-	-	100	80	-	5	5	40	50	Poorly to moderately sorted pebble gravel; pebbles are between 1-2 cm long and are angular; mtx.-supported, massive.
④	2.9 m		[illegible]	≠	Olive grey-brown	⅄	Fe mottled												Massive, organic-rich silts; colour is mottled black to olive grey-brown; minor Fe-staining.
③	2.7 m	A-SA	sharp	= c	Light grey-brown				40	-	25	75	60	20	15	15	40	10	See Unit#1; no boulders.
②	2.3 m		[illegible]	≠	Olive grey-brown														Massive fine sand to silt; clay stringers throughout; discontinuous gritty lenses in uppermost 10 cm.
①	1.4 m	A-SA	sharp	= c	Light grey-brown				40	5	20	75	60	20	15	15	40	10	Poorly sorted, mtx.-supported, pebble-cobble gravel; pebbles and cobbles are angular to subangular; boulders are rounded and are predominantly granodiorite in composition; crudely stratified.
	0 m		covered																Covered interval, slumped debris

Legend

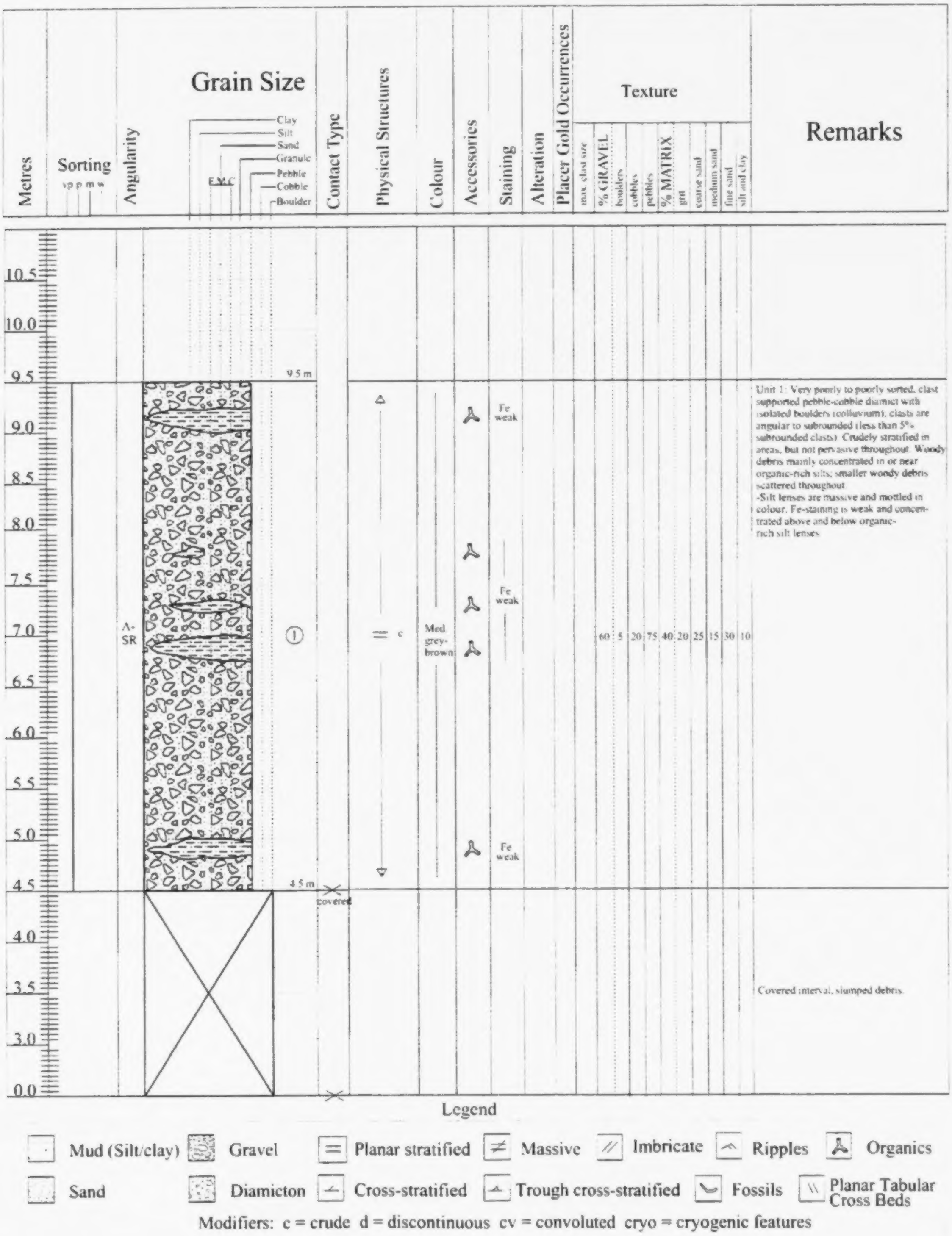
Mud (Silt/clay)	Gravel	= Planar stratified	≠ Massive	// Imbricate	Ripples	⅄ Organics
Sand	Diamicton	Cross-stratified	Trough cross-stratified	Fossils	Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 26/08/97 Section number: LW-97-19 Measured by: LW/LM Creek or River: Dublin Gulch NTS: 106D4

Latitude: 64°02'04''N Longitude: 135°49'15''W Elevation: 2975 UTM: 459850E,7101000N

Orientation: 222° ⟷ 042° upstream Geomorphic landform: Colluvial Apron

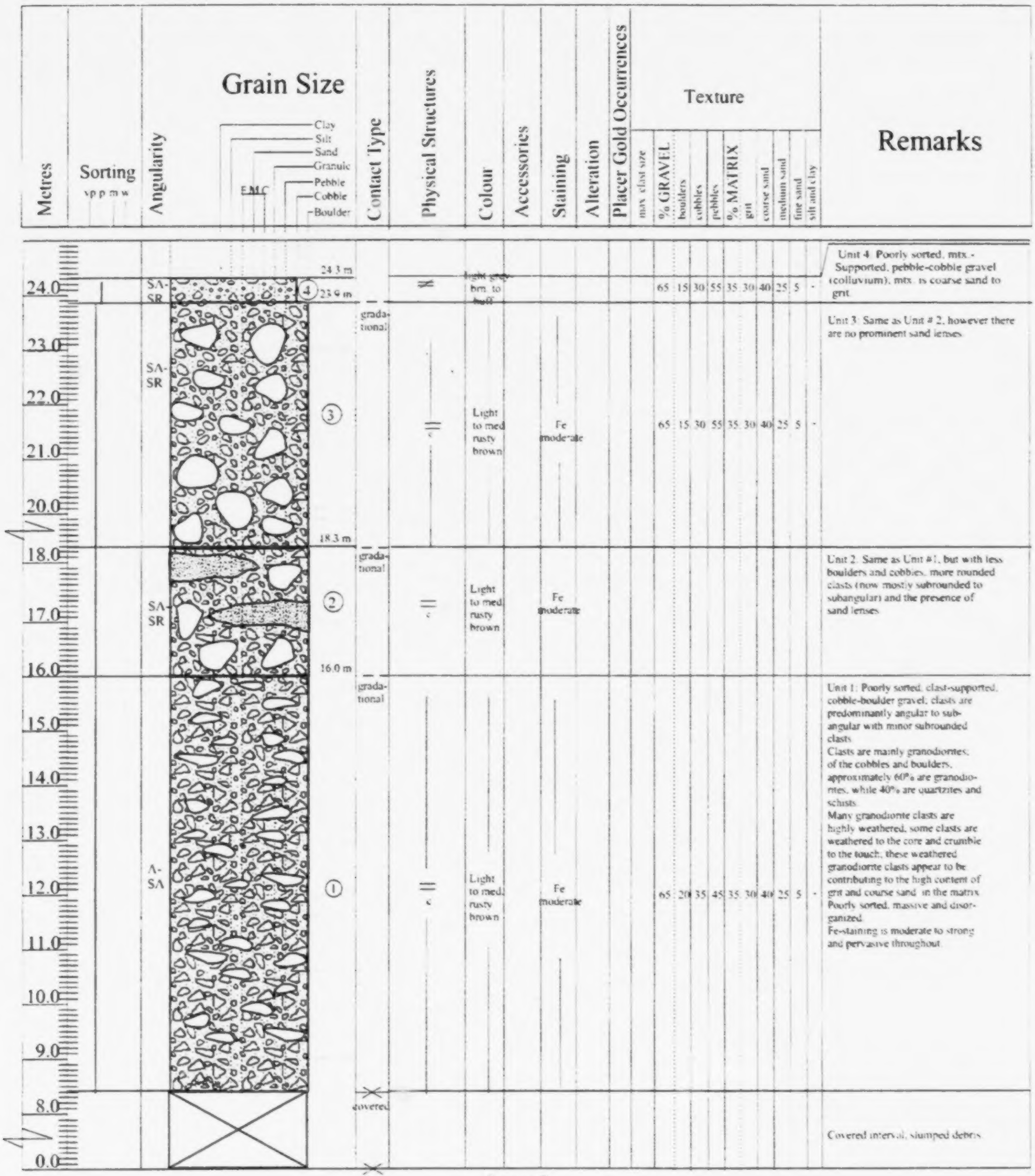


Unit 1: Very poorly to poorly sorted, clast supported pebble-cobble diamict with isolated boulders (colluvium); clasts are angular to subrounded (less than 5% subrounded clasts). Crudely stratified in areas, but not pervasive throughout. Woody debris mainly concentrated in or near organic-rich silts; smaller woody debris scattered throughout.

-Silt lenses are massive and mottled in colour. Fe-staining is weak and concentrated above and below organic-rich silt lenses.

Covered interval, slumped debris.

Date: 27/08/97 Section number: LW-97-20 Measured by: LW/LM Creek or River: Dublin Gulch NTS: 106D4
Latitude: 64°02'00''N Longitude: 135°49'41''W Elevation: 2825 UTM: 459500E,7100875N
Orientation: 244° ⟷ 064° upstream Geomorphic landform: Gulch Gravel/Colluvial Apron



Metres	Angularity	Grain Size	Contact Type	Physical Structures	Colour	Accessories	Staining	Alteration	Placer Gold Occurrences	max clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay	Remarks
23.9 m – 24.3 m	SA-SR	④		≠	light grey-brn. to buff						65	15	30	55	35	30	40	25	5	-	Unit 4. Poorly sorted, mtx.-Supported, pebble-cobble gravel (colluvium), mtx. is coarse sand to grit.
18.3 m – 23.9 m	SA-SR	③	gradational	= c	Light to med rusty brown		Fe moderate				65	15	30	55	35	30	40	25	5	-	Unit 3: Same as Unit # 2, however there are no prominent sand lenses.
16.0 m – 18.3 m	SA-SR	②	gradational	= c	Light to med rusty brown		Fe moderate														Unit 2. Same as Unit #1, but with less boulders and cobbles, more rounded clasts (now mostly subrounded to subangular) and the presence of sand lenses.
8.3 m – 16.0 m	A-SA	①	gradational	= c	Light to med. rusty brown		Fe moderate				65	20	35	45	35	30	40	25	5	-	Unit 1: Poorly sorted, clast-supported, cobble-boulder gravel; clasts are predominantly angular to subangular with minor subrounded clasts. Clasts are mainly granodiorites; of the cobbles and boulders, approximately 60% are granodiorites, while 40% are quartzites and schists. Many granodiorite clasts are highly weathered, some clasts are weathered to the core and crumble to the touch; these weathered granodiorite clasts appear to be contributing to the high content of grit and course sand in the matrix. Poorly sorted, massive and disorganized. Fe-staining is moderate to strong and pervasive throughout.
0.0 – 8.3 m			covered																		Covered interval, slumped debris.

Legend

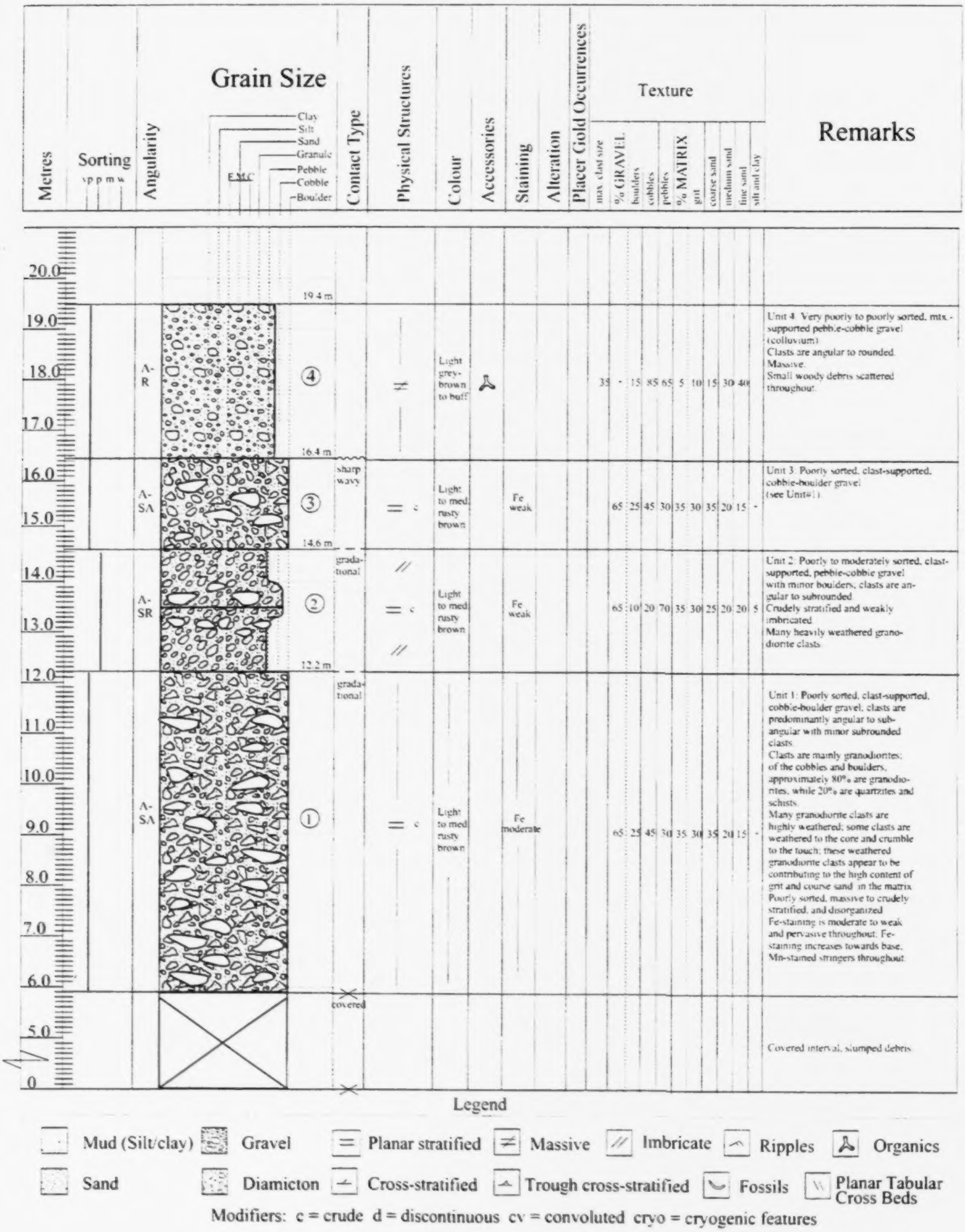
- Mud (Silt/clay)
- Sand
- Gravel
- Diamicton
- = Planar stratified
- ⟋ Cross-stratified
- ≠ Massive
- Trough cross-stratified
- // Imbricate
- Ripples
- Fossils
- Organics
- \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 27/08/97 Section number: LW-97-21 Measured by: LW/LM Creek or River: Dublin Gulch NTS: 106D4

Latitude: 64°02'00"N Longitude: 135°49'47"W Elevation: 2790 UTM: 459400E.7100875N

Orientation: 244° ←→ 064° upstream Geomorphic landform: Gulch Gravel/Colluvial Apron



Unit 4: Very poorly to poorly sorted, mtx.-supported pebble-cobble gravel (colluvium)
Clasts are angular to rounded.
Massive.
Small woody debris scattered throughout.

Unit 3: Poorly sorted, clast-supported, cobble-boulder gravel (see Unit#1)

Unit 2: Poorly to moderately sorted, clast-supported, pebble-cobble gravel with minor boulders, clasts are angular to subrounded
Crudely stratified and weakly imbricated
Many heavily weathered granodiorite clasts

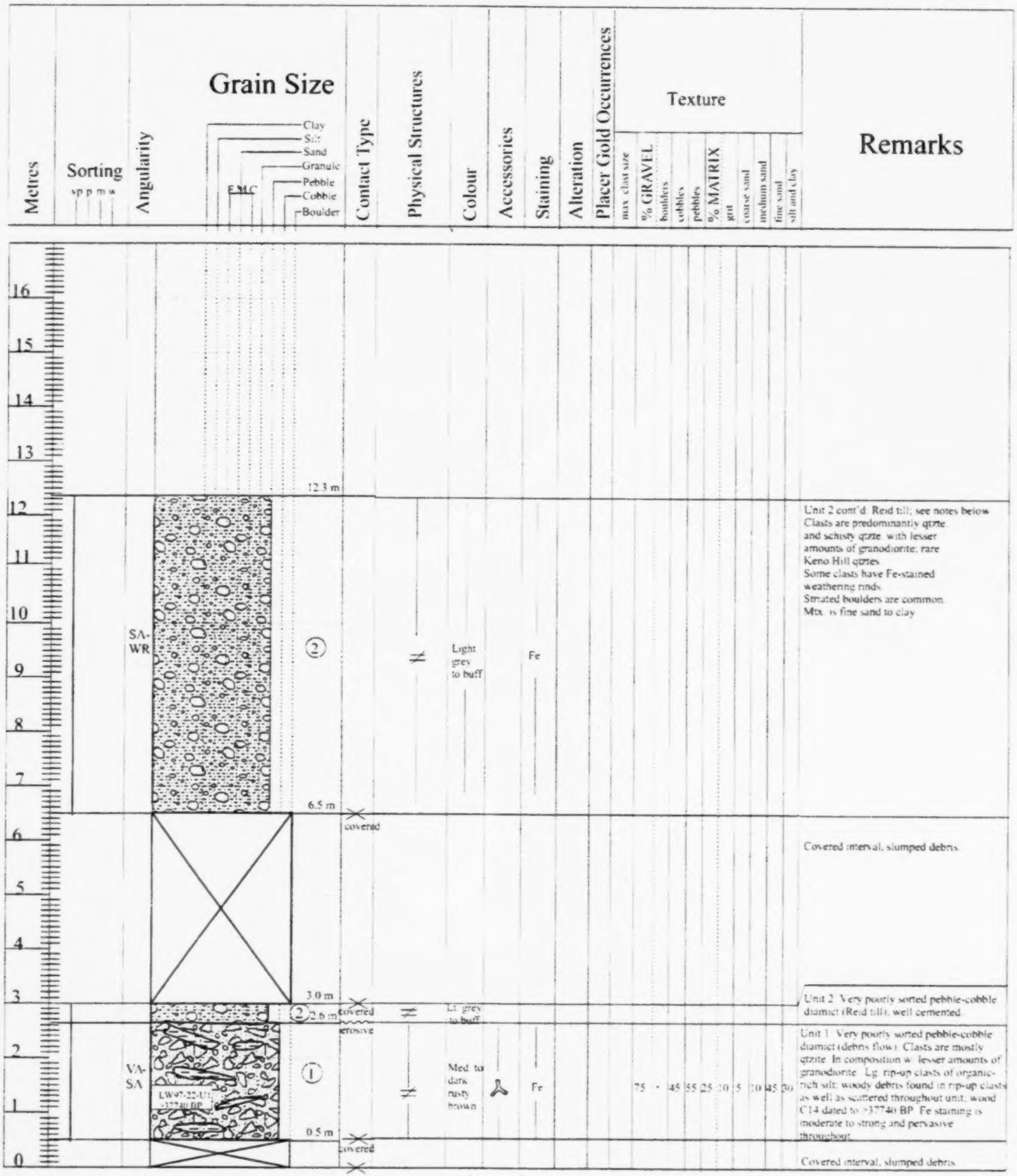
Unit 1: Poorly sorted, clast-supported, cobble-boulder gravel; clasts are predominantly angular to subangular with minor subrounded clasts
Clasts are mainly granodiorites; of the cobbles and boulders, approximately 80% are granodiorites, while 20% are quartzites and schists.
Many granodiorite clasts are highly weathered; some clasts are weathered to the core and crumble to the touch; these weathered granodiorite clasts appear to be contributing to the high content of grit and course sand in the matrix
Poorly sorted, massive to crudely stratified, and disorganized
Fe-staining is moderate to weak and pervasive throughout; Fe-staining increases towards base.
Mn-stained stringers throughout.

Covered interval, slumped debris.

Date: 28/08/97 Section number: LW-97-22 Measured by: LW/LM Creek or River: Dublin Gulch NTS: 106D4

Latitude: 64°01'52''N Longitude: 135°50'11''W Elevation: 2750 ft UTM: 459100E,7100675N

Orientation: 242° ⟷ 062° upstream Geomorphic landform: Debris Flow/Reid Till



Unit 2 cont'd. Reid till; see notes below
Clasts are predominantly qtzte
and schisty qtzte. with lesser
amounts of granodiorite; rare
Keno Hill qtztes
Some clasts have Fe-stained
weathering rinds.
Striated boulders are common.
Mtx. is fine sand to clay

Covered interval, slumped debris.

Unit 2. Very poorly sorted pebble-cobble diamict (Reid till), well cemented.

Unit 1. Very poorly sorted pebble-cobble diamict (debris flow). Clasts are mostly qtzite. In composition w/ lesser amounts of granodiorite. Lg. rip-up clasts of organic-rich silt; woody debris found in rip-up clasts as well as scattered throughout unit; wood C14 dated to >37740 BP. Fe staining is moderate to strong and pervasive throughout.

Covered interval, slumped debris

Legend

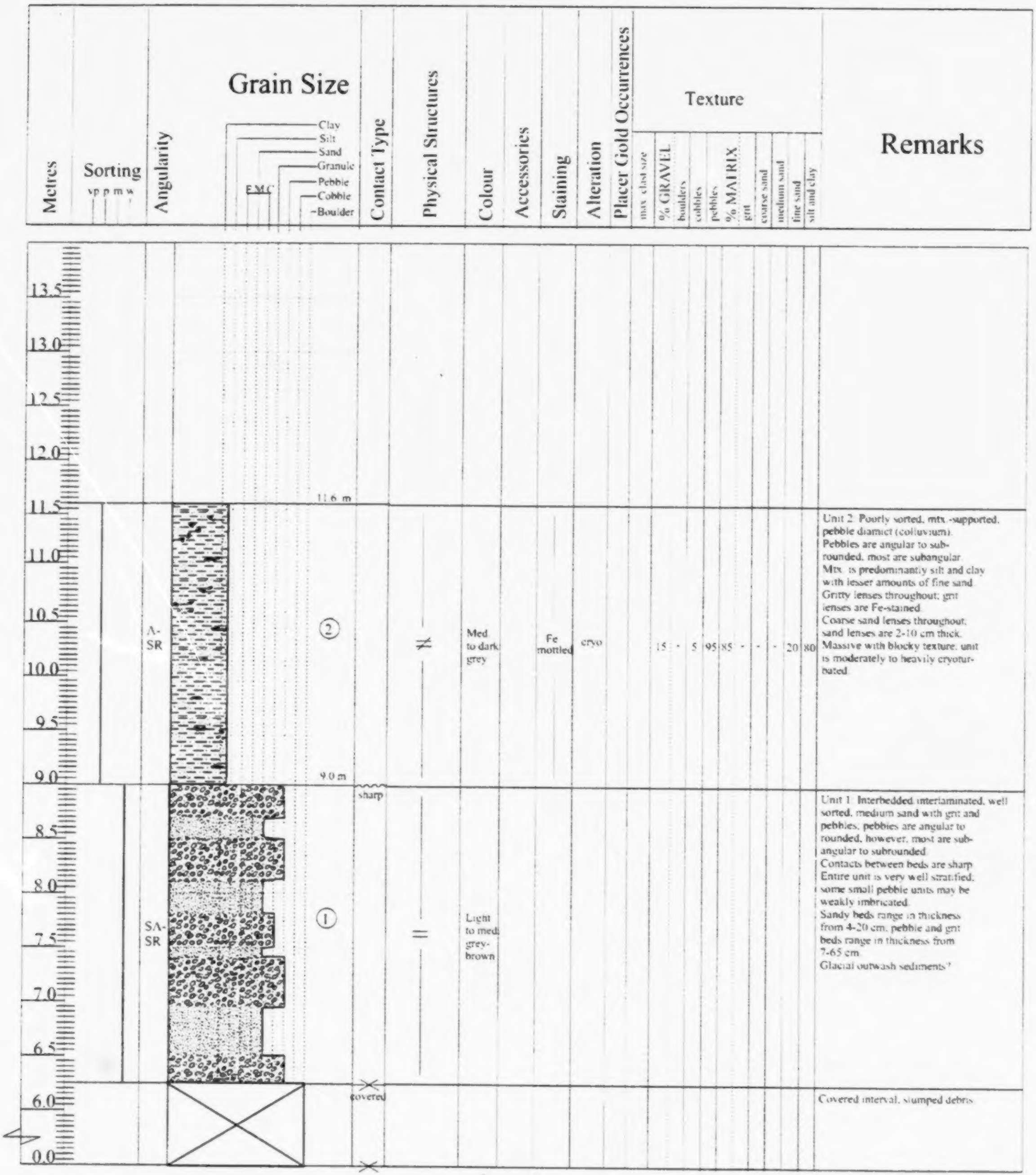
☐ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics
░ Sand	▨ Diamicton	∠ Cross-stratified	⌃ Trough cross-stratified	◡ Fossils	\\ Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 01/09/97 Section number: LW-97-23 Measured by: LW/LM Creek or River: Dublin Gulch NTS: 106D4

Latitude: 64°01'50''N Longitude: 135°51'26''W Elevation: 2720 UTM: 458875E,7100625N

Orientation: 242° ⟷ 062° upstream Geomorphic landform: Galciofuvial Outwash/Colluvial Apron



Unit 2: Poorly sorted, mtx.-supported, pebble diamict (colluvium). Pebbles are angular to subrounded, most are subangular. Mtx. is predominantly silt and clay with lesser amounts of fine sand. Gritty lenses throughout; grit lenses are Fe-stained. Coarse sand lenses throughout; sand lenses are 2-10 cm thick. Massive with blocky texture; unit is moderately to heavily cryoturbated.

Unit 1: Interbedded interlaminated, well sorted, medium sand with grit and pebbles; pebbles are angular to rounded, however, most are subangular to subrounded. Contacts between beds are sharp. Entire unit is very well stratified; some small pebble units may be weakly imbricated. Sandy beds range in thickness from 4-20 cm, pebble and grit beds range in thickness from 7-65 cm. Glacial outwash sediments?

Covered interval, slumped debris

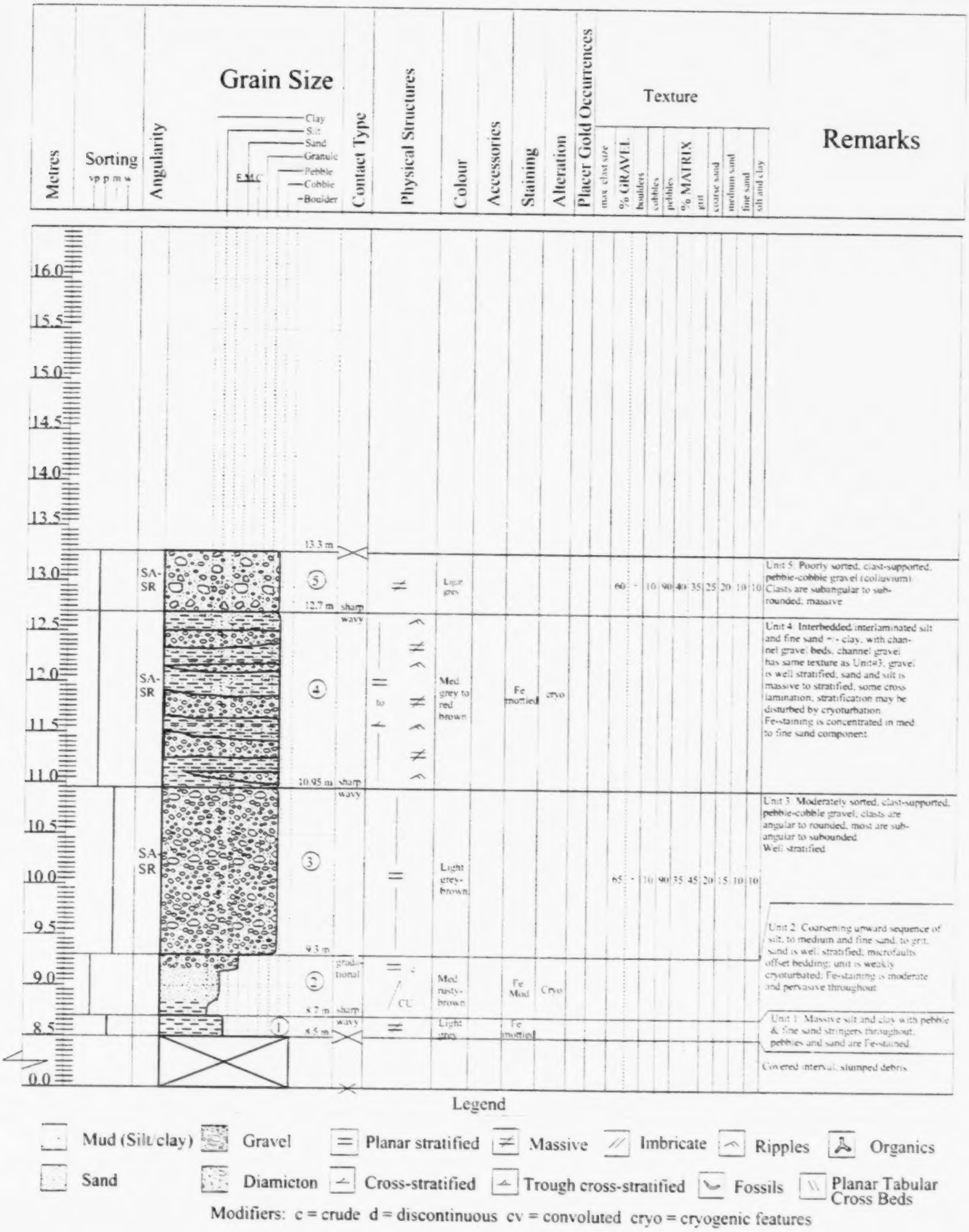
Legend

Mud (Silt/clay) Gravel = Planar stratified ≠ Massive // Imbricate Ripples Organics

Sand Diamicton Cross-stratified Trough cross-stratified Fossils Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 05/09/97 Section number: LW-97-24 Measured by: LW/LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 6-°00'32''N Longitude: 135°51'11''W Elevation: 2430 UTM: 458250E.7098225N
Orientation: 066° ⟷ 246° Geomorphic landform: Alluvial Fan/Colluvial Apron



Unit 5: Poorly sorted, clast-supported, pebble-cobble gravel (colluvium). Clasts are subangular to subrounded; massive

Unit 4: Interbedded/interlaminated silt and fine sand +/- clay, with channel gravel beds, channel gravel has same texture as Unit#3, gravel is well stratified; sand and silt is massive to stratified, some cross lamination, stratification may be disturbed by cryoturbation. Fe-staining is concentrated in med to fine sand component.

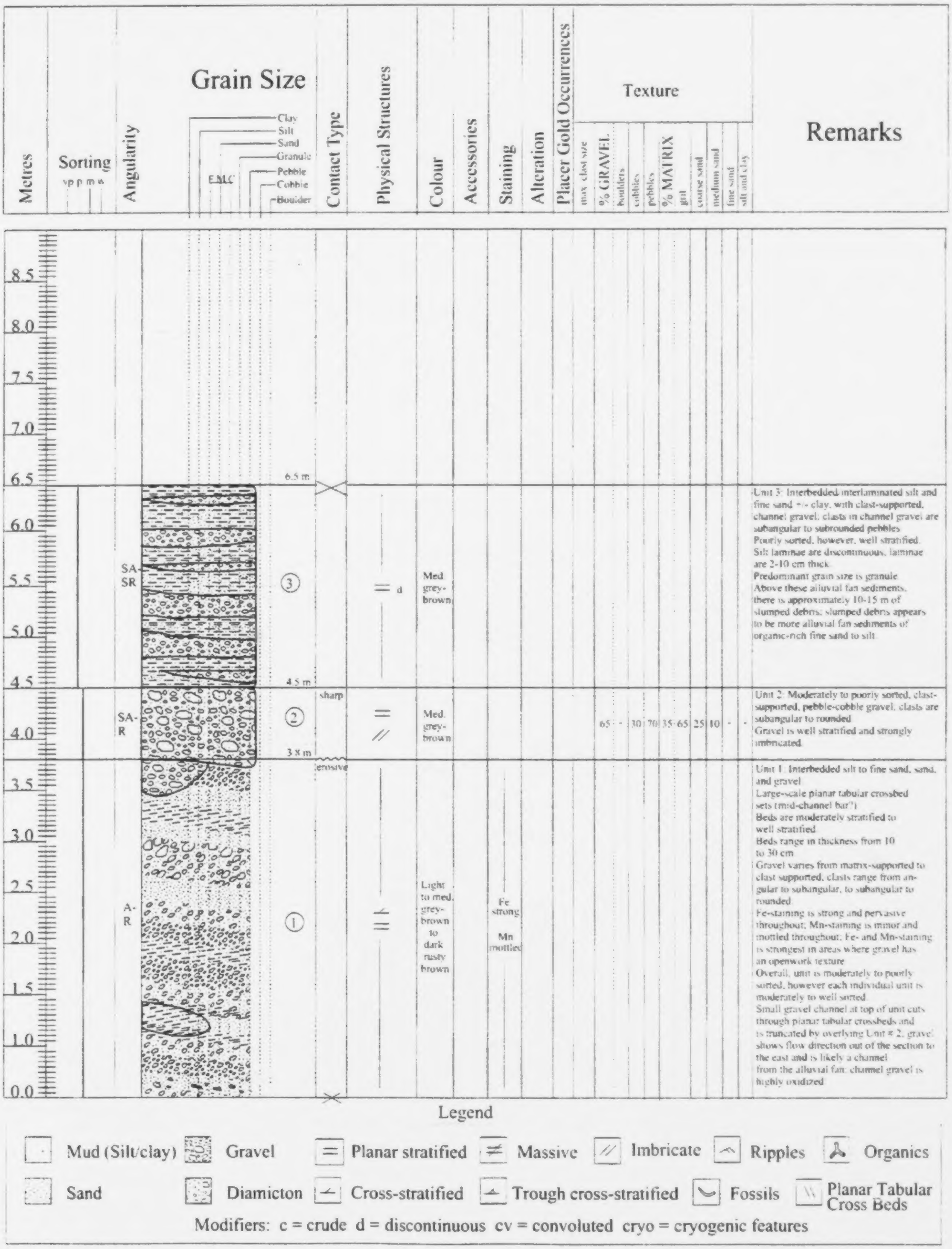
Unit 3: Moderately sorted, clast-supported, pebble-cobble gravel, clasts are angular to rounded, most are subangular to subrounded. Well stratified

Unit 2: Coarsening upward sequence of silt, to medium and fine sand, to grit, sand is well stratified; microfaults offset bedding; unit is weakly cryoturbated. Fe-staining is moderate and pervasive throughout

Unit 1: Massive silt and clay with pebble & fine sand stringers throughout, pebbles and sand are Fe-stained

Covered interval; slumped debris

Date: 05/09/97 Section number: LW-97-25 Measured by: LW/LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°00'32''N Longitude: 135°51'11''W Elevation: 2420 ft UTM: 458250E,7098225N
Orientation: 170° ⟷ 350° upstream Geomorphic landform: Alluvial Plain/Alluvial Fan

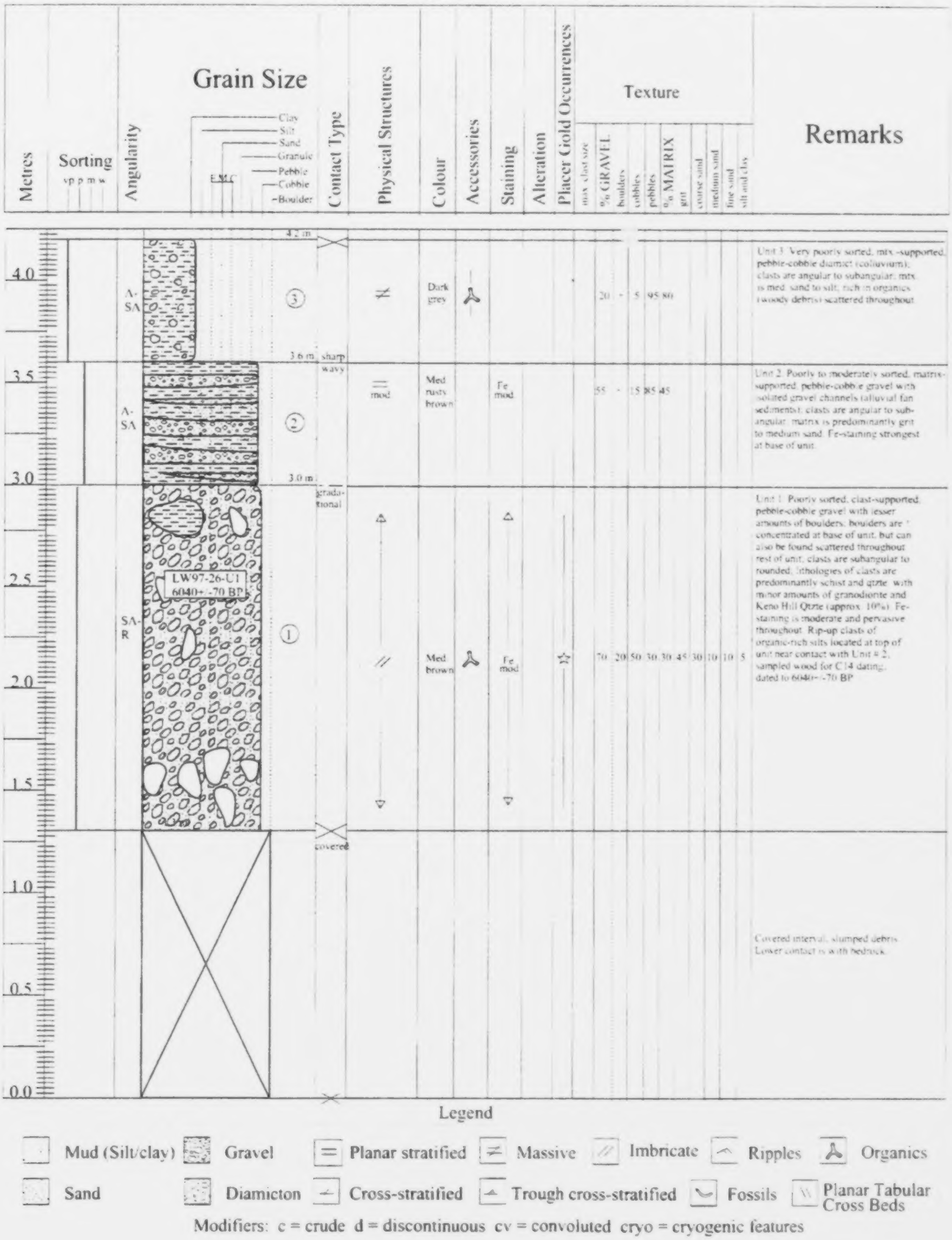


Unit 3: Interbedded interlaminated silt and fine sand +/- clay, with clast-supported, channel gravel; clasts in channel gravel are subangular to subrounded pebbles
Poorly sorted, however, well stratified.
Silt laminae are discontinuous, laminae are 2-10 cm thick
Predominant grain size is granule
Above these alluvial fan sediments, there is approximately 10-15 m of slumped debris; slumped debris appears to be more alluvial fan sediments of organic-rich fine sand to silt

Unit 2: Moderately to poorly sorted, clast-supported, pebble-cobble gravel, clasts are subangular to rounded
Gravel is well stratified and strongly imbricated

Unit 1: Interbedded silt to fine sand, sand, and gravel
Large-scale planar tabular crossbed sets (mid-channel bar?)
Beds are moderately stratified to well stratified
Beds range in thickness from 10 to 30 cm
Gravel varies from matrix-supported to clast supported, clasts range from angular to subangular, to subangular to rounded
Fe-staining is strong and pervasive throughout; Mn-staining is minor and mottled throughout; Fe- and Mn-staining is strongest in areas where gravel has an openwork texture
Overall, unit is moderately to poorly sorted, however each individual unit is moderately to well sorted
Small gravel channel at top of unit cuts through planar tabular crossbeds and is truncated by overlying Unit # 2; gravel shows flow direction out of the section to the east and is likely a channel from the alluvial fan; channel gravel is highly oxidized

Date: 09/05/97 Section number: LW-97-26 Measured by: LW/LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°00'26''N Longitude: 135°51'11''W Elevation: 2435 ft UTM: 458250E,7098050N
Orientation: 165° ↔ 345° upstream Geomorphic landform: Alluvial Plain/Alluvial Fan/Colluvial Apron



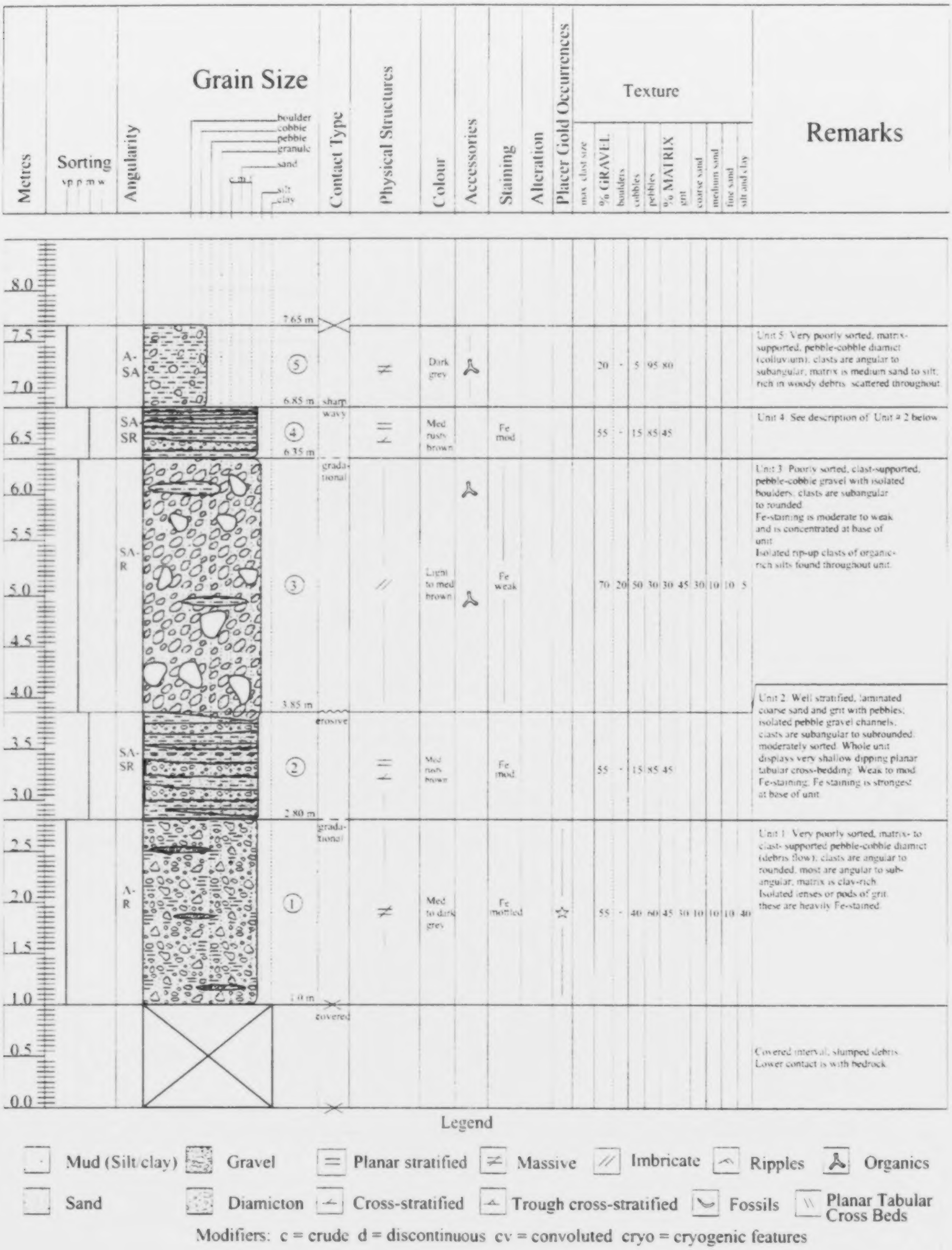
Unit 3. Very poorly sorted, mtx.-supported, pebble-cobble diamict (colluvium); clasts are angular to subangular; mtx is med. sand to silt; rich in organics (woody debris) scattered throughout.

Unit 2. Poorly to moderately sorted, matrix-supported, pebble-cobble gravel with isolated gravel channels (alluvial fan sediments); clasts are angular to subangular; matrix is predominantly grit to medium sand. Fe-staining strongest at base of unit.

Unit 1. Poorly sorted, clast-supported, pebble-cobble gravel with lesser amounts of boulders; boulders are concentrated at base of unit, but can also be found scattered throughout rest of unit; clasts are subangular to rounded; lithologies of clasts are predominantly schist and qtzte with minor amounts of granodiorite and Keno Hill Qtzte (approx. 10%). Fe-staining is moderate and pervasive throughout. Rip-up clasts of organic-rich silts located at top of unit near contact with Unit # 2; sampled wood for C14 dating; dated to 6040+/-70 BP.

Covered interval, slumped debris. Lower contact is with bedrock.

Date: 09/07/97 Section number: LW-97-27 Measured by: LW LM Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°00'26"N Longitude: 135°51'11"W Elevation: 2400 UTM: 458250E,7098050N
Orientation: 162° ⟷ 342° upstream Geomorphic landform: Alluvial Plain/Alluvial Fan/Colluvial Apron



Unit 5: Very poorly sorted, matrix-supported, pebble-cobble diamict (colluvium); clasts are angular to subangular; matrix is medium sand to silt; rich in woody debris scattered throughout.

Unit 4: See description of Unit # 2 below.

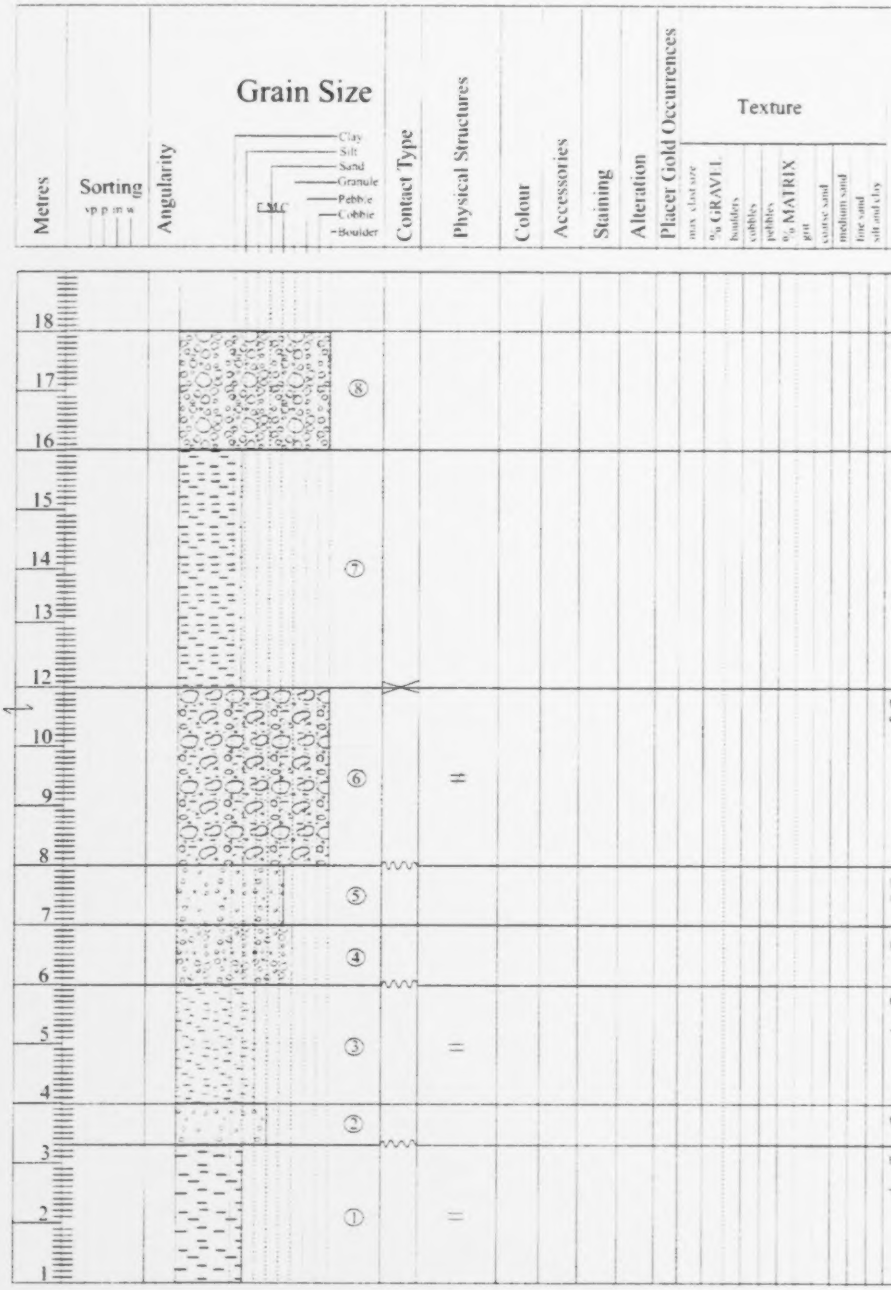
Unit 3: Poorly sorted, clast-supported, pebble-cobble gravel with isolated boulders; clasts are subangular to rounded.
Fe-staining is moderate to weak and is concentrated at base of unit.
Isolated rip-up clasts of organic-rich silts found throughout unit.

Unit 2: Well stratified, laminated coarse sand and grit with pebbles; isolated pebble gravel channels; clasts are subangular to subrounded; moderately sorted. Whole unit displays very shallow dipping planar tabular cross-bedding. Weak to mod Fe-staining; Fe staining is strongest at base of unit.

Unit 1: Very poorly sorted, matrix- to clast- supported pebble-cobble diamict (debris flow); clasts are angular to rounded, most are angular to subangular; matrix is clay-rich. Isolated lenses or pods of grit; these are heavily Fe-stained.

Covered interval, slumped debris. Lower contact is with bedrock.

Date: 7/08/95 Section number: RH1-95 Measured by: WPL Creek or River: Haggart Creek NTS: 106D4
Latitude: 64°01.03 Longitude: 135°51.18 Elevation: 2540 ft UTM:
Orientation: 300 ⟷ 120 Geomorphic landform: Remnant moraine (terrace)



Remarks

Unit 8: Cobble boulder gravels

-crudely stratified
-angular

Unit 7: Stratified fine silt and clay

Unit 6: Pebble cobble diamicton

Unit 5: Pebbly medium-course sand

Unit 4: Sandy pebble gravel

Unit 3: Fine sand and silt

-stratified

Unit 2: pebbly medium sand

Unit 1: fine sand and silt

-planar stratified

Legend

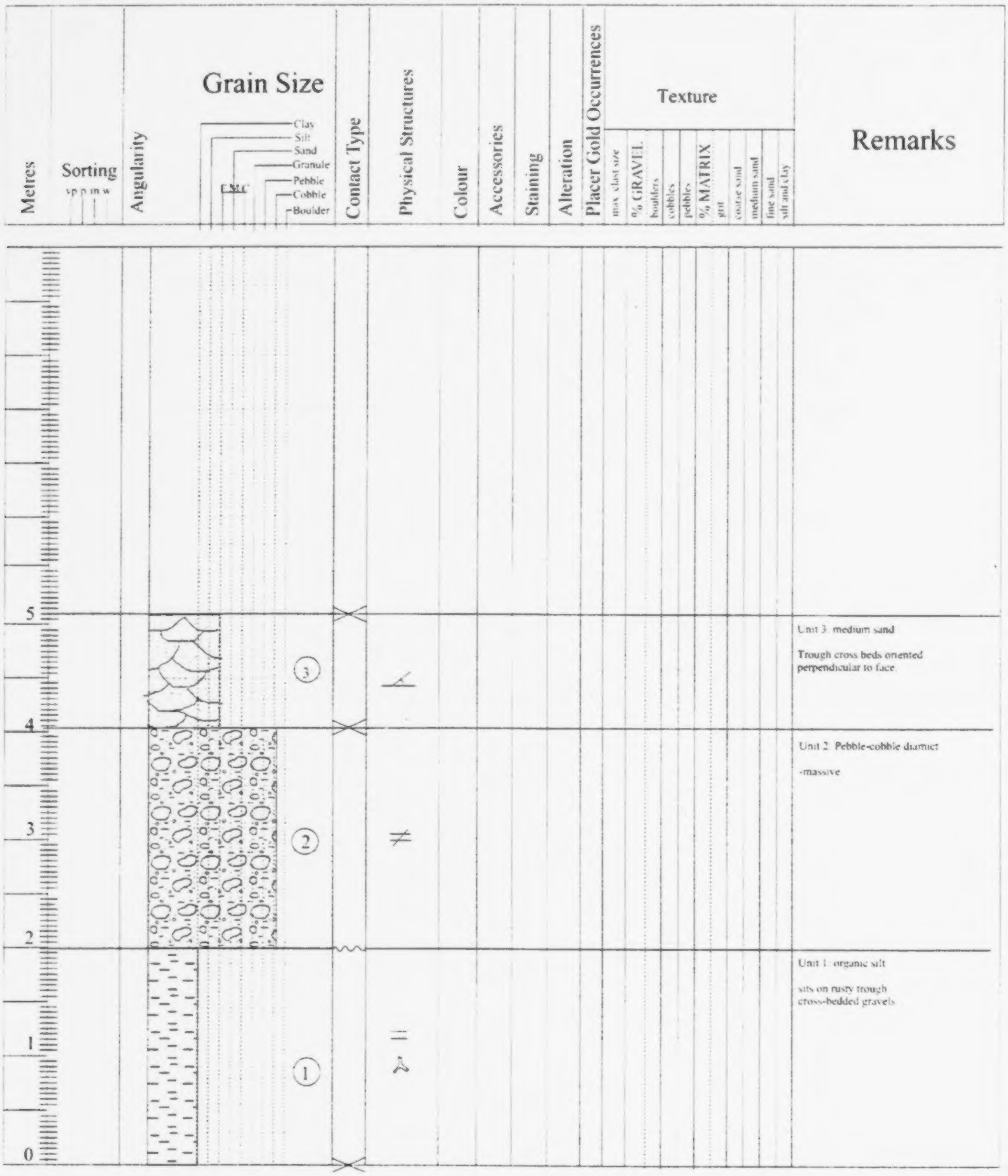
☐ Mud (Silt/clay) ▨ Gravel = Planar stratified ≠ Massive // Imbricate ⌒ Ripples ⅄ Organics
☐ Sand ▨ Diamicton ⊥ Cross-stratified ⊥ Trough cross-stratified ◡ Fossils \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 24 09 95 Section number: RH2-95 Measured by: WPL Creek or River: Haggart Creek NTS: ________

Latitude: 64°00'.9 N Longitude: 135°51'.06W Elevation: 2530 ft UTM: ________

Orientation: 252 ⟷ 72 Geomorphic landform: ________



Unit 3: medium sand

Trough cross beds oriented perpendicular to face.

Unit 2: Pebble-cobble diamict

-massive

Unit 1: organic silt

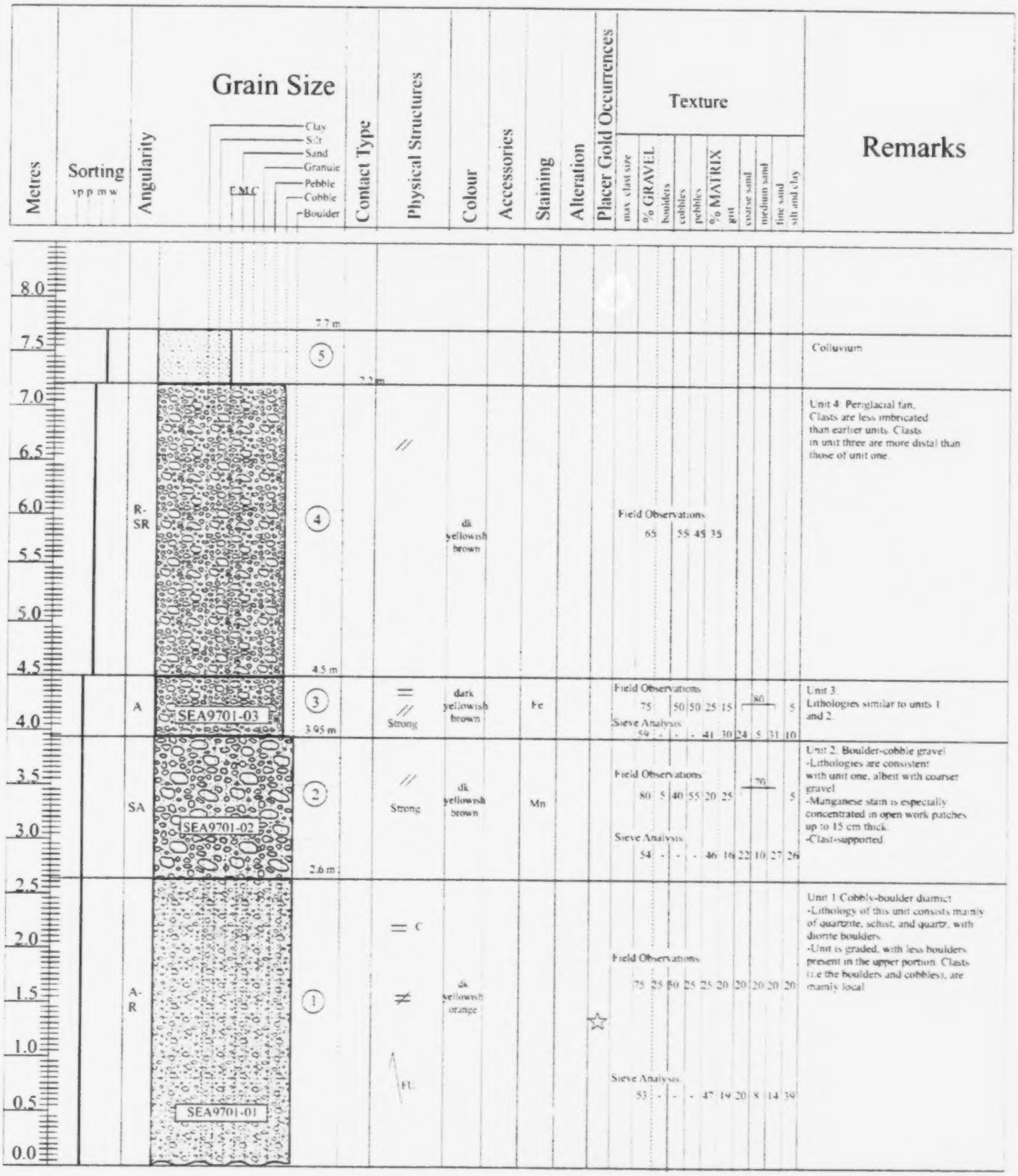
sits on rusty trough cross-bedded gravels

Legend

- ⬚ Mud (Silt/clay)
- ▨ Gravel
- = Planar stratified
- ≠ Massive
- // Imbricate
- ⌒ Ripples
- ⅄ Organics
- ⬚ Sand
- ▨ Diamicton
- ∠ Cross-stratified
- ∠ Trough cross-stratified
- ⌣ Fossils
- \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 02/07/97 Section number: SEA9701 Measured by: TA, WL Creek or River: Seattle Creek NTS: 115 P/16
Latitude: 63°49'17 Longitude: 136°04'2.3" Elevation: 2600 ft UTM: N7077354, E0447463
Orientation: 170° ⟷ 350° Geomorphic landform: Alluvial Fan



Colluvium

Unit 4: Periglacial fan. Clasts are less imbricated than earlier units. Clasts in unit three are more distal than those of unit one.

Unit 3. Lithologies similar to units 1 and 2.

Unit 2. Boulder-cobble gravel
-Lithologies are consistent with unit one, albeit with coarser gravel
-Manganese stain is especially concentrated in open work patches up to 15 cm thick.
-Clast-supported

Unit 1 Cobbly-boulder diamict
-Lithology of this unit consists mainly of quartzite, schist, and quartz, with diorite boulders.
-Unit is graded, with less boulders present in the upper portion. Clasts (i.e the boulders and cobbles), are mainly local

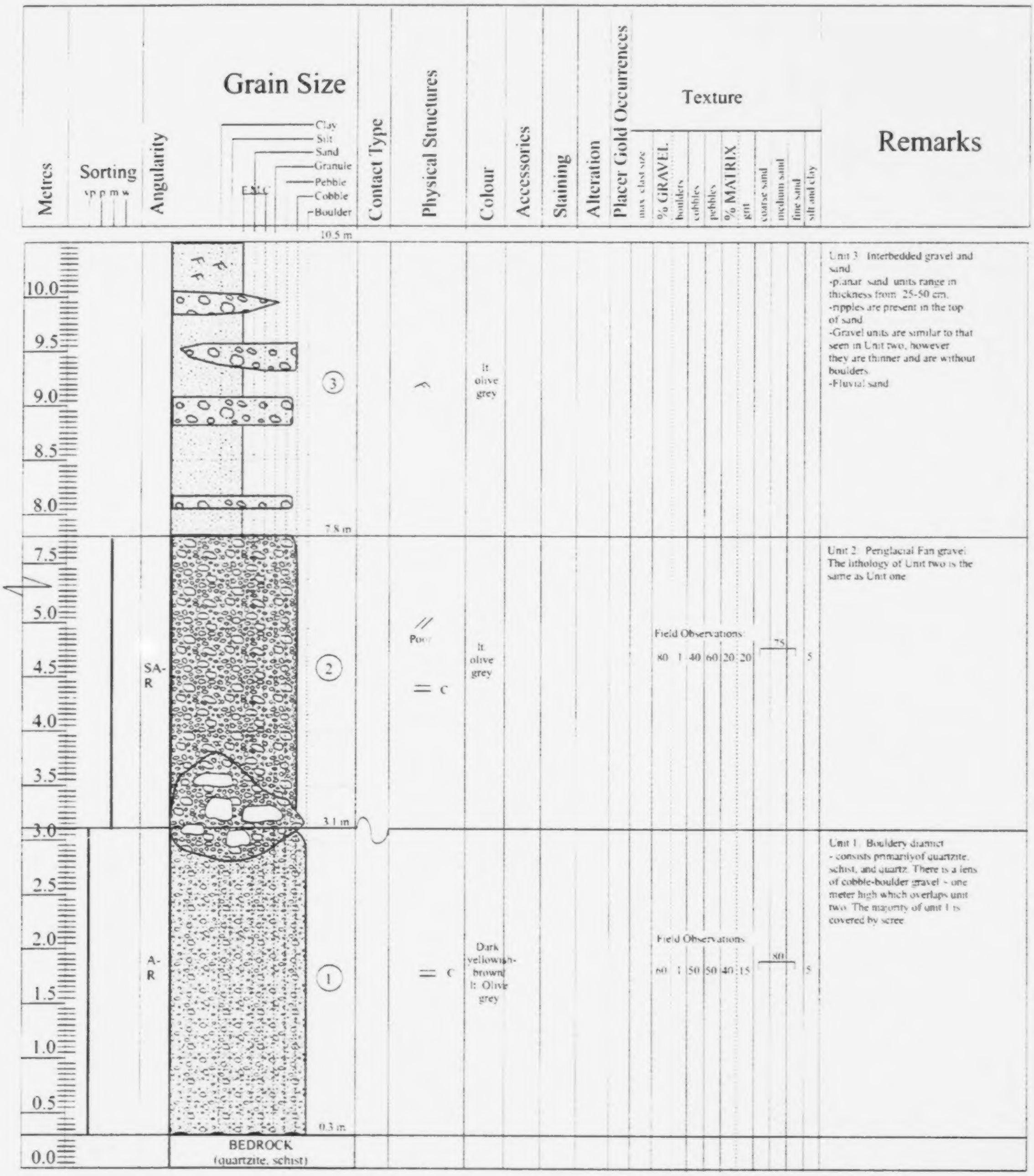
Legend

☐	Mud (Silt/clay)	▨	Gravel	=	Planar stratified	≠	Massive	//	Imbricate	⌒	Ripples
▨	Sand	▨	Diamicton	⌐	Cross-stratified	⌐	Trough cross-stratified	◡	Fossils	\\\\	Planar Tabular Cross Beds

Organics

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 03 07 97 Section number: SEA9702 Measured by: TA, WL Creek or River: Seattle Creek NTS: 115 P 16
Latitude: 63°49'17" Longitude: 136°04'2.3" Elevation: 2550 ft UTM: 0447463E, 7077354N
Orientation: 170° ⟷ 350° Geomorphic landform: Alluvial Fan



Unit 3 Interbedded gravel and sand
-planar sand units range in thickness from 25-50 cm.
-ripples are present in the top of sand
-Gravel units are similar to that seen in Unit two, however they are thinner and are without boulders.
-Fluvial sand

Unit 2 Periglacial Fan gravel
The lithology of Unit two is the same as Unit one.

Unit 1 Bouldery diamict
- consists primarilyof quartzite, schist, and quartz. There is a lens of cobble-boulder gravel ~ one meter high which overlaps unit two. The majority of unit 1 is covered by scree

Legend

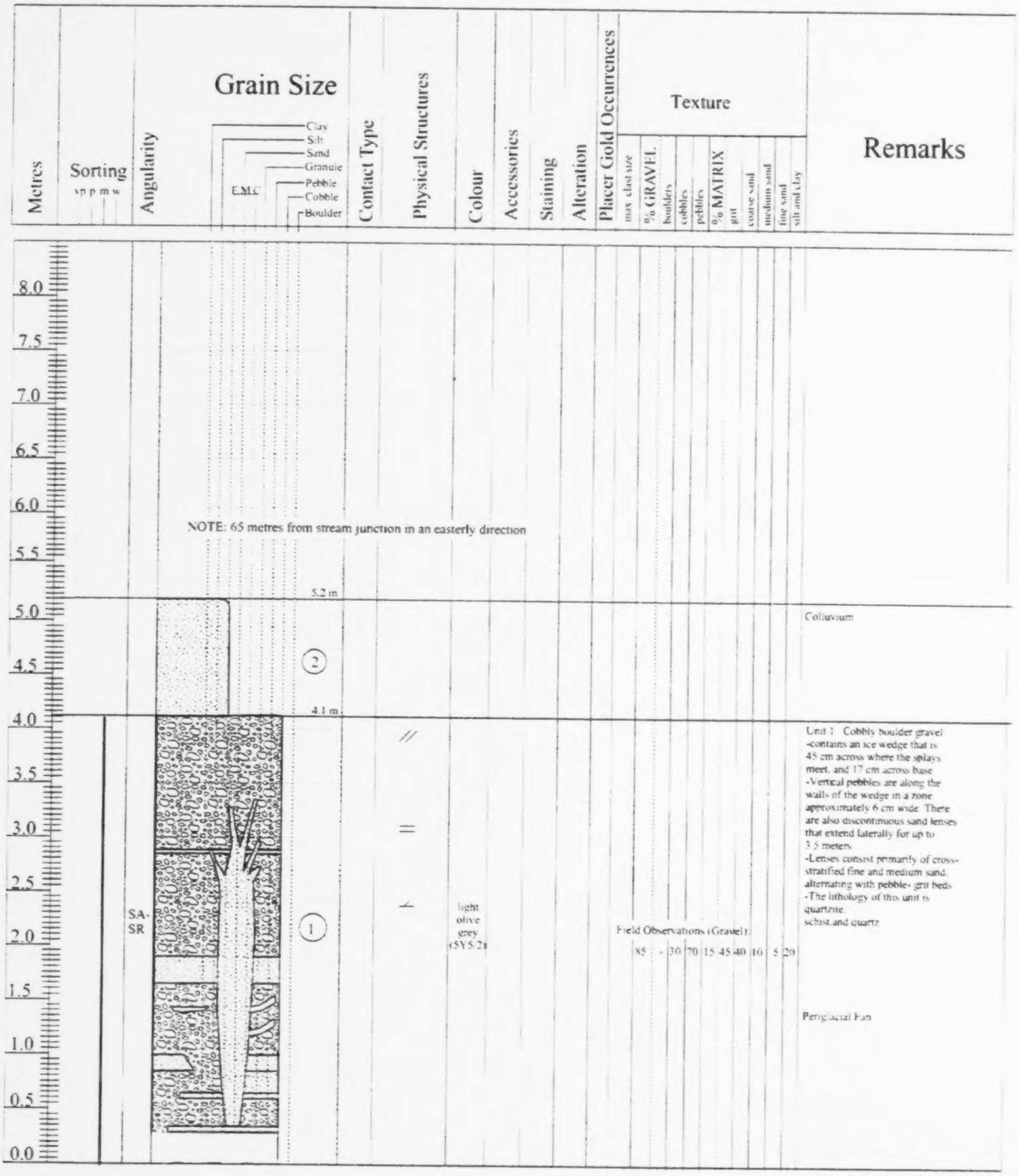
- ⬚ Mud (Silt/clay)
- ▨ Gravel
- = Planar stratified
- ≠ Massive
- // Imbricate
- ⌒ Ripples
- ⅄ Organics
- ⬚ Sand
- ▨ Diamicton
- ⊥ Cross-stratified
- ⊥ Trough cross-stratified
- ◡ Fossils
- \\ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 04/07/97 Section number: SEA9703 Measured by: TA, WL Creek or River: Seattle Creek NTS: 115 P/16

Latitude: 63°49'17 Longitude: 136°04'02 Elevation: 2550 ft UTM: N7077354 E0447463

Orientation: 250° ⟷ 070° Geomorphic landform: Periglacial Alluvial Fan



NOTE: 65 metres from stream junction in an easterly direction

Colluvium

Unit 1 Cobbly boulder gravel
-contains an ice wedge that is 45 cm across where the splays meet, and 17 cm across base
-Vertical pebbles are along the walls of the wedge in a zone approximately 6 cm wide. There are also discontinuous sand lenses that extend laterally for up to 3.5 meters
-Lenses consist primarily of cross-stratified fine and medium sand, alternating with pebble- grit beds
-The lithology of this unit is quartzite, schist and quartz

Field Observations (Gravel):

max clast size	% GRAVEL	boulders	cobbles	pebbles	% MATRIX	grit	coarse sand	medium sand	fine sand	silt and clay
85		-	30	70	15	45	40	10	5	20

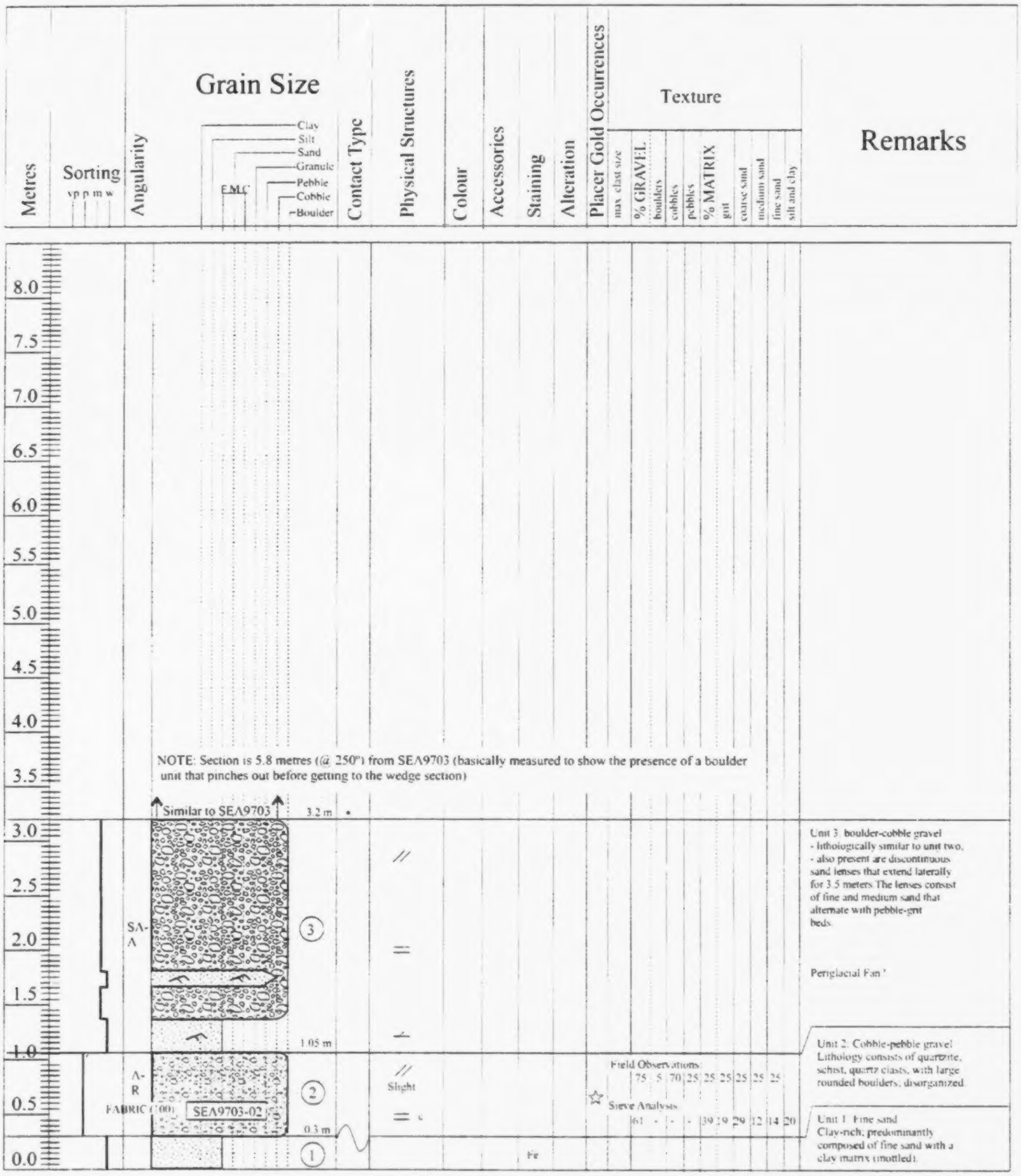
Periglacial Fan

Legend

Mud (Silt/clay)
Gravel
= Planar stratified
Massive
// Imbricate
Ripples
Organics
Sand
Diamicton
Cross-stratified
Trough cross-stratified
Fossils
Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 03/07/97 Section number: SEA9704 Measured by: TA, WL Creek or River: Seattle Creek NTS: 115 P/16
Latitude: 63°49'17" Longitude: 136°04'02" Elevation: ______ UTM: N7077354, E0447463
Orientation: 250° ⟷ 070° Geomorphic landform: Periglacial Alluvial Fan



NOTE: Section is 5.8 metres (@ 250°) from SEA9703 (basically measured to show the presence of a boulder unit that pinches out before getting to the wedge section)

Unit 3: boulder-cobble gravel
- lithologically similar to unit two.
- also present are discontinuous sand lenses that extend laterally for 3.5 meters The lenses consist of fine and medium sand that alternate with pebble-grit beds.

Periglacial Fan?

Unit 2: Cobble-pebble gravel
Lithology consists of quartzite, schist, quartz clasts, with large rounded boulders, disorganized

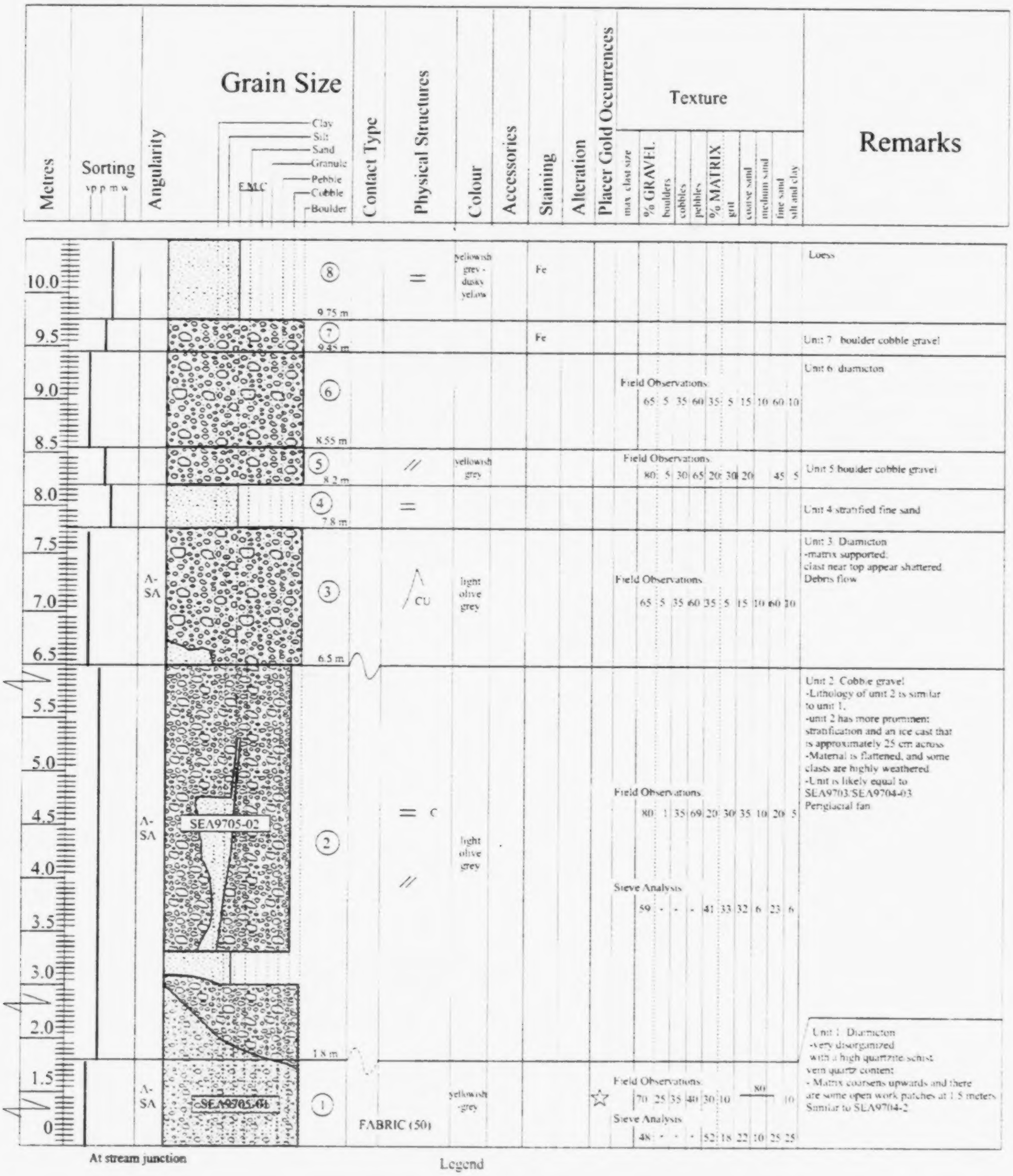
Unit 1: Fine sand
Clay-rich; predominantly composed of fine sand with a clay matrix (mottled).

Legend

⬚	Mud (Silt/clay)	▨	Gravel	=	Planar stratified	≠	Massive	//	Imbricate	⌒	Ripples	⅄	Organics
⬚	Sand	▨	Diamicton	∠	Cross-stratified	⌒	Trough cross-stratified	◡	Fossils	\\	Planar Tabular Cross Beds		

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 04/07/97 Section number: SEA9705 Measured by: TA, WL Creek or River: Seattle Creek NTS: 115 P/16
Latitude: 63°49'23.2" Longitude: 136°04'0.4" Elevation: 2550 ft UTM: E0447491, N7077546
Orientation: 235° ⟷ 055° Geomorphic landform: Periglacial Alluvial Fan



Loess

Unit 7 boulder cobble gravel

Unit 6 diamicton
Field Observations
65 5 35 60 35 5 15 10 60 10

Unit 5 boulder cobble gravel
Field Observations
80 5 30 65 20 30 20 45 5

Unit 4 stratified fine sand

Unit 3 Diamicton
-matrix supported.
clast near top appear shattered
Debris flow
Field Observations
65 5 35 60 35 5 15 10 60 10

Unit 2 Cobble gravel
-Lithology of unit 2 is similar to unit 1.
-unit 2 has more prominent stratification and an ice cast that is approximately 25 cm across
-Material is flattened, and some clasts are highly weathered
-Unit is likely equal to SEA9703/SEA9704-03
Periglacial fan
Field Observations
80 1 35 69 20 30 35 10 20 5
Sieve Analysis
59 - - - 41 33 32 6 23 6

Unit 1 Diamicton
-very disorganized with a high quartzite schist vein quartz content
- Matrix coarsens upwards and there are some open work patches at 1.5 meters
Similar to SEA9704-2
☆
Field Observations
70 25 35 40 30 10 80 10
Sieve Analysis
48 - - - 52 18 22 10 25 25

Legend

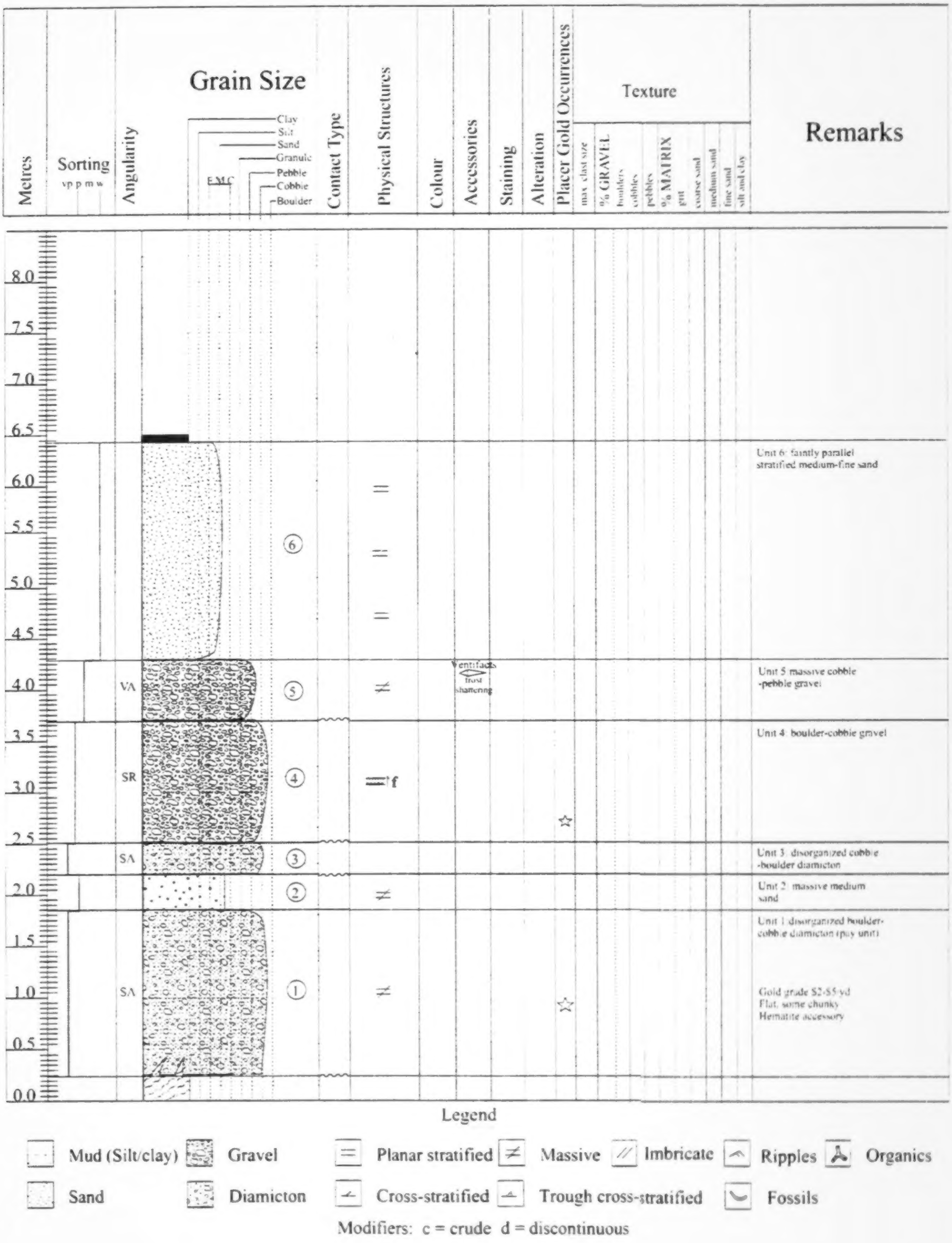
Mud (Silt/clay)	Gravel	= Planar stratified	≠ Massive	// Imbricate	Ripples	Organics
Sand	Diamicton	Cross-stratified	Trough cross-stratified	Fossils	Planar Tabular Cross Beds	

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

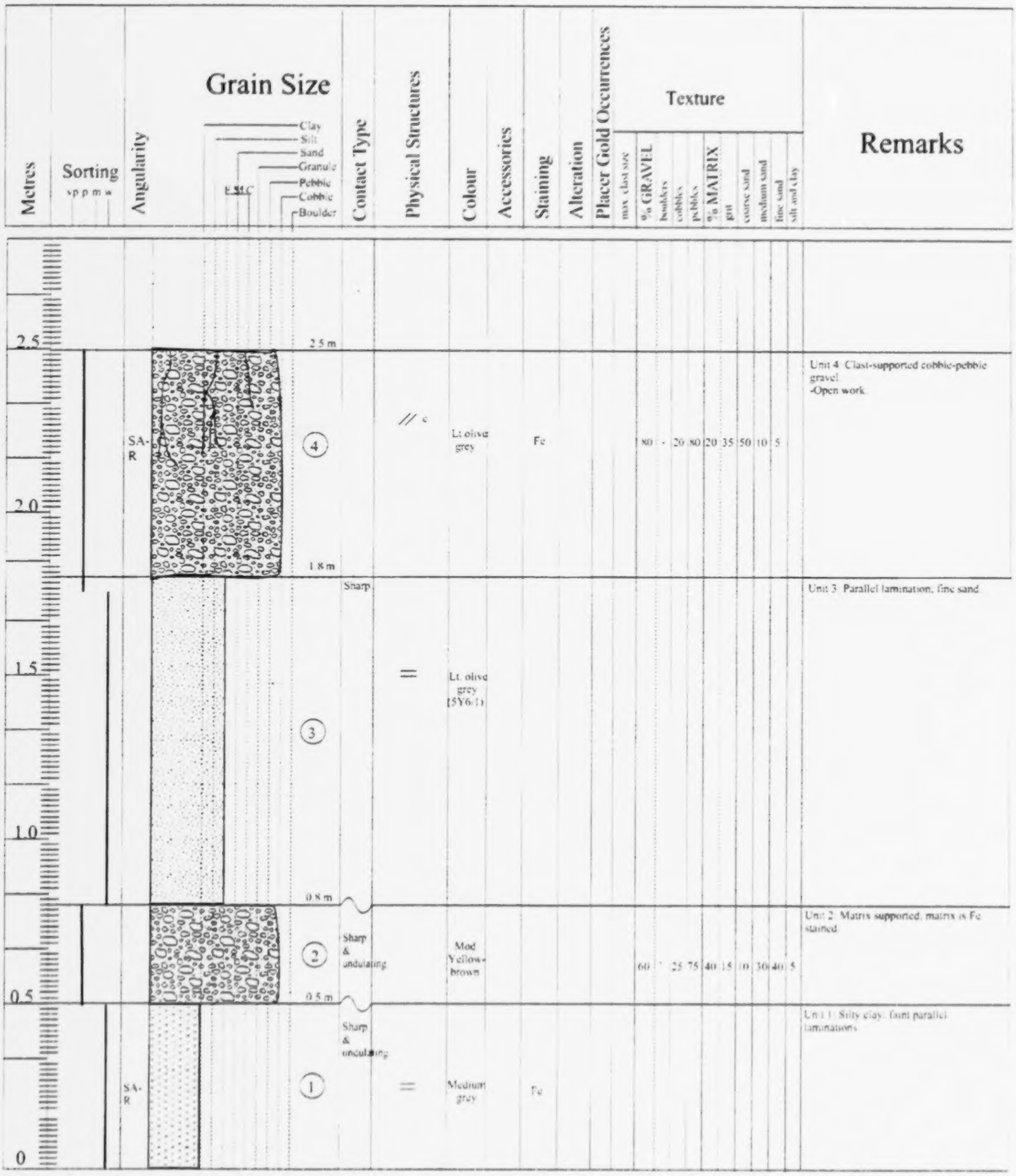
Date: 08/08/95 Section number: GD1-95 Measured by: WPL Creek or River: Goodman Creek NTS: 115P16

Latitude 63°55'36"N Longitude: 136°11'33"W Elevation: 2380 UTM: 0441450E,7089250N

Orientation: 285 ⟷ 105 upstream Geomorphic landform: Periglacial Fan



Date: 12/08/97 Section number: GDM9701 Measured by: TA, DP Creek or River: Goodman Creek NTS: 115P/16
Latitude: ________ Longitude: ________ UTM: 443231E, 7087331N Elevation: 2200 ft
Orientation: 180 (ds) ⟷ 360 (us) Geomorphic landform: ________



Unit 4: Clast-supported cobble-pebble gravel.
-Open work.

Unit 3: Parallel lamination, fine sand.

Unit 2: Matrix supported, matrix is Fe stained.

Unit 1: Silty clay; faint parallel laminations.

Legend

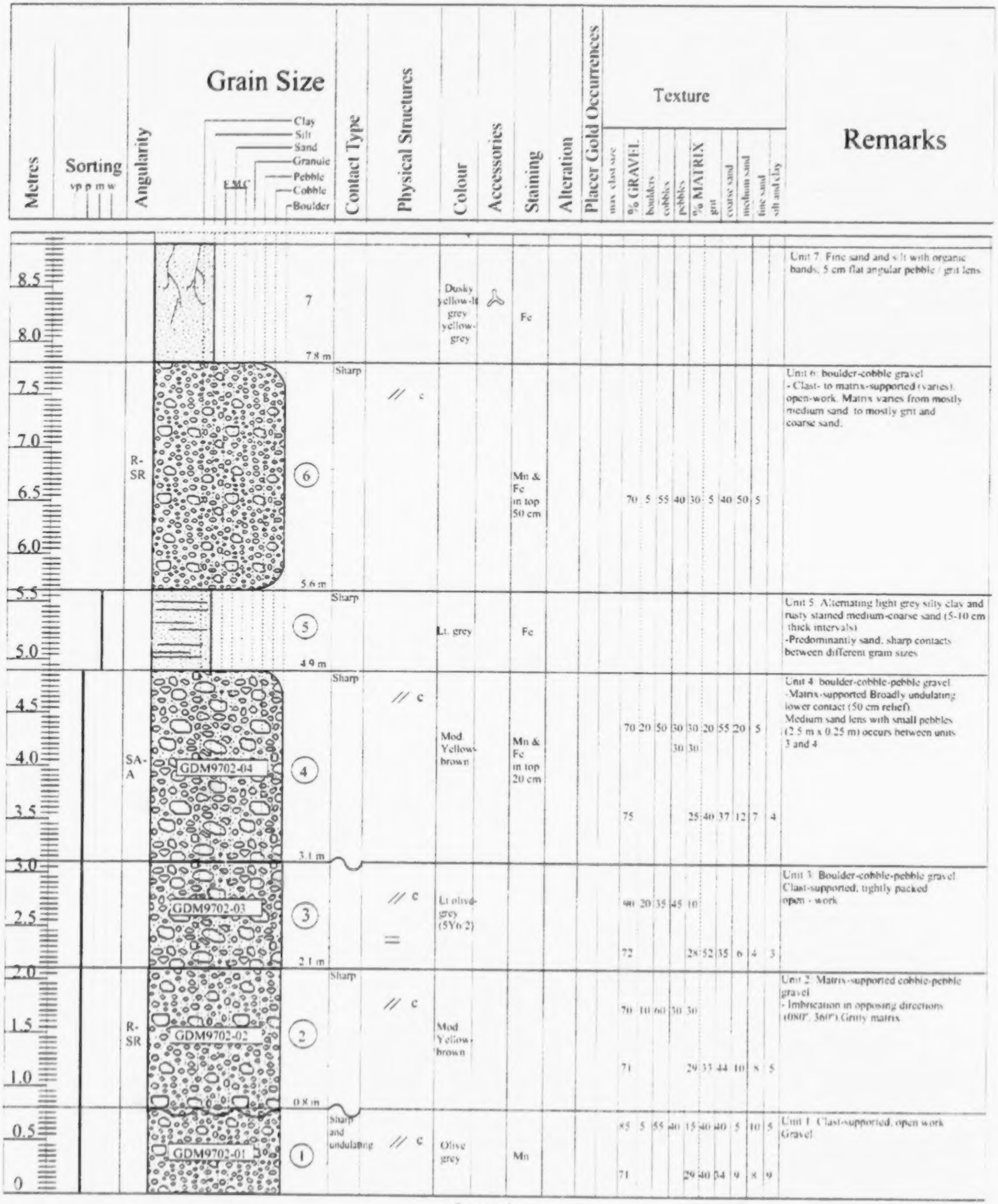
▫ Mud (Silt/clay)	▨ Gravel	= Planar stratified	≠ Massive	// Imbricate	⌒ Ripples	⅄ Organics	
░ Sand	▨ Diamicton	⌐ Cross-stratified	⌐ Trough cross-stratified	◡ Fossils	\\\\ Planar Tabular Cross Beds		

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 12/08/97 Section number: GDM9702 Measured by: TA, DP Creek or River: Goodman Creek NTS: 115P/16

Latitude: 63°54'21.7" Longitude: 136°08'57.1" UTM: 443596E, 7086881N Elevation: 2050 ft

Orientation: 080 (ds) ⟷ 260 (us) Geomorphic landform: ____________



Unit 7. Fine sand and silt with organic bands, 5 cm flat angular pebble / grit lens

Unit 6: boulder-cobble gravel
- Clast- to matrix-supported (varies), open-work. Matrix varies from mostly medium sand to mostly grit and coarse sand.

Unit 5: Alternating light grey silty clay and rusty stained medium-coarse sand (5-10 cm thick intervals)
-Predominantly sand, sharp contacts between different grain sizes

Unit 4: boulder-cobble-pebble gravel
-Matrix-supported Broadly undulating lower contact (50 cm relief)
Medium sand lens with small pebbles (2.5 m x 0.25 m) occurs between units 3 and 4

Unit 3: Boulder-cobble-pebble gravel
Clast-supported, tightly packed open - work

Unit 2: Matrix-supported cobble-pebble gravel
- Imbrication in opposing directions (080°, 360°) Gritty matrix

Unit 1. Clast-supported, open work Gravel

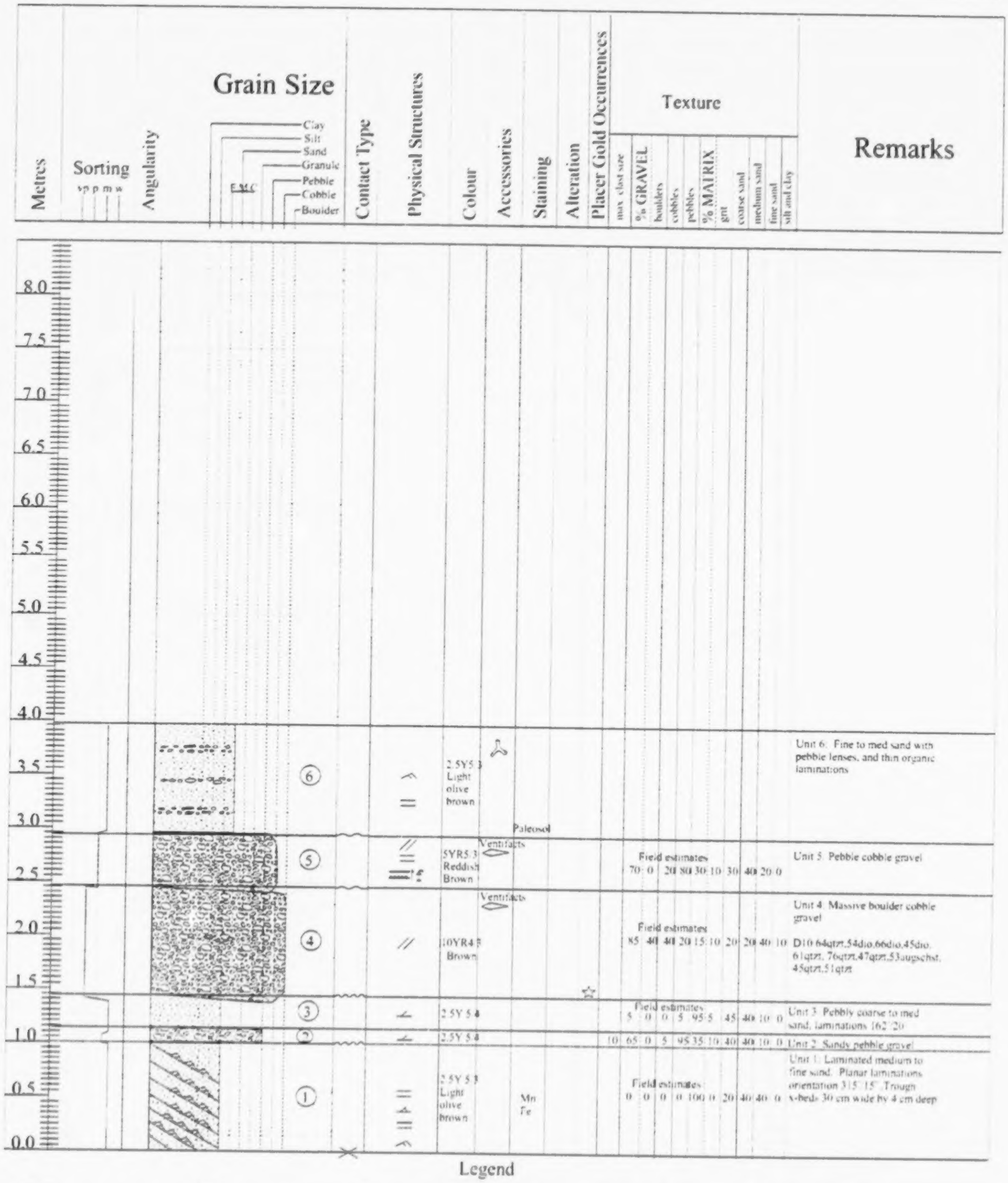
Legend

☐ Mud (Silt/clay) ▨ Gravel ☐ Planar stratified ☐ Massive ☐ Imbricate ☐ Ripples ☐ Organics

☐ Sand ☐ Diamicton ☐ Cross-stratified ☐ Trough cross-stratified ☐ Fossils ☐ Planar Tabular Cross Beds

Modifiers: c = crude d = discontinuous cv = convoluted cryo = cryogenic features

Date: 06/08/97 Section number: ROD97-1 Measured by: WPL/DM Creek or River: Rodin Creek NTS: 115P16
Latitude: 63°53'09"N Longitude: 136°17'47"W Elevation: 2500 UTM: 0436333E,7084754N
Orientation: 160 ↔ 340 upstream Geomorphic landform: Glaciofluvial Terrace



Unit	Colour	Texture	Remarks
6	2.5Y5/3 Light olive brown		Unit 6: Fine to med sand with pebble lenses, and thin organic laminations
5	5YR5/3 Reddish Brown	Field estimates 70 0 20 80 30 10 30 40 20 0	Unit 5: Pebble cobble gravel
4	10YR4/3 Brown	Field estimates 85 40 40 20 15 10 20 20 40 10	Unit 4: Massive boulder cobble gravel D10 64qtzt,54dio,66dio,45dio, 61qtzt, 76qtzt,47qtzt,53augschst, 45qtzt,51qtzt
3	2.5Y 5/4	Field estimates 5 0 0 5 95 5 45 40 10 0	Unit 3: Pebbly coarse to med sand, laminations 162°/20
2	2.5Y 5/4	10 65 0 5 95 35 10 40 40 10 0	Unit 2: Sandy pebble gravel
1	2.5Y 5/3 Light olive brown	Field estimates 0 0 0 0 100 0 20 40 40 0	Unit 1: Laminated medium to fine sand. Planar laminations orientation 315°/15°. Trough x-beds 30 cm wide by 4 cm deep

Legend

- ☐ Mud (Silt/clay)
- ▨ Gravel
- ☐ Sand
- ▨ Diamicton
- = Planar stratified
- ≠ Massive
- // Imbricate
- Ripples
- Organics
- Cross-stratified
- Trough cross-stratified
- Fossils

Modifiers: c = crude d = discontinuous

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